2

MARINE ENGINEERING

AND SHIPPING AGE

INDEX TO VOLUME XXVII

JANUARY TO DECEMBER, 1922

PUBLISHED BY

ALDRICH PUBLISHING COMPANY

IN CONJUNCTION WITH

SIMMONS-BOARDMAN PUBLISHING CO.

Woolworth Building, New York, U. S. A.

34 Victoria Street, Westminster, S. W. I., London, England

INDEX

Note—Illustrated articles are marked with an (*) asterisk

ARTICLES

COMMUNICATIONS

EDITORIALS

PERSONALS

QUESTIONS AND ANSWERS

TECHNICAL PUBLICATIONS

Marine Engineering
and Shipping Age

Volume XXVII | January, 1922 | Number 1

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
S. M. PHILLIPS, Associate Editor L. S. BLODGETT, Associate Editor
W. Z. GARDNER, News Editor

Contributing Editors

Rear Admiral C. W. Dyson, U. S. N.
Commander S. M. Robinson, U. S. N.
Professor C. H. Peabody
Captain C. A. McAllister, U.S.C.G, (Retired)
William Gatewood
H. McL. Harding
William T. Donnelly
James L. Bates

WE GUARANTEE that of this issue 5,750 copies were printed; that of these 5,750 copies 4,128 were mailed to regular paid subscribers, 523 were provided for counter and news company sales, 268 were mailed to advertisers, 37 were mailed to employees and correspondents and 794 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 5,750—an average of 5,750 copies a month.

MARING ENGINEERING is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulations (A. B C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

The Administration's Views Anticipated

CHAIRMAN LASKER of the Shipping Board may not always correctly reflect the views of the President, but as he prefaced his speech before the Association of Commerce at Milwaukee on December 13 with the statement that "it was my honored privilege to submit the manuscript of this address to President Harding, whose passion to see America successful on the ocean is second to none" it may be safely assumed that there is nothing in this speech that does not meet with the hearty approval of our Chief Executive.

With this in view, a comparison of Chairman Lasker's remarks relating to the "Arms Conference and the Merchant Marine" with the leading editorial in the December issue of MARINE ENGINEERING AND SHIPPING AGE, which was written over three weeks before Mr. Lasker delivered his speech, is most interesting, showing as it does an apparent endorsement of our views.

After praising the Limitations Conference "as one of the glorious jewels in the crown of American accomplishments" Mr. Lasker immediately proceeds with the following statement: "Granting that the 5-5-3 naval program, or some equivalent, be adopted and that we have a naval holiday for a term of years, the question of naval equality is not solved; because if in addition to the equalized navies any one nation possesses a merchant marine of convertible strength vastly beyond that of another nation, the nation possessing that added convertible merchant tonnage has the preponderance of naval power."

Compare the above with our December editorial which starts as follows: "We are in full accord with the principle of the limitation of armaments and the cessation of the mad race for naval supremacy in "capital ships" which in the end can only mean financial ruin for the nations involved. But as great sea battles were fought in the days of ancient Rome with wooden vessels propelled by oars, so could terrible conflicts be waged today with the giant ocean liners hastily equipped with aerial, chemical and submarine instruments of warfare too numerous to mention. America must not forget that the importance of England's and Japan's great fleets of ocean liners will increase in far greater than direct proportion to the number of warships scrapped."

Chairman Lasker, although depreciating the possibility of a war between this country and Great Britain, gave comparative figures showing the relative superiority of the British merchant marine for convertible purposes. He said, "taking into consideration passenger and cargo ships of 8,000 tons and over which represent the very cream of the merchant marine convertible for naval purposes, Great Britain possesses 234 ships of this type already completed and the United States possesses 54 ships, a ratio of 4.3 to 1 in favor of Great Britain. Taking into consideration vessels of this type now actually building in both countries, the ratio in favor of Great Britain will be increased to 5 to 1."

MARINE ENGINEERING AND SHIPPING AGE has repeatedly advocated the reconditioning of the ex-German liners and the construction of new passenger ships. We do not expect war but we do know that it is easier to respect a nation that is an equal in strength than one that is comparatively impotent. It will be a wonder indeed if everything goes along smoothly in the future and this country having no axes to grind, no territory that it wishes to acquire, will be lax in its duty to the world if it suffers its naval strength to fall to any such standard as 1 to 5. We must rank somewhere near as equal in strength in our convertible merchant marine to other countries in order that our passion for peace may not be jeopardized.

But that is not all, for there are at least thirteen good and sufficient commercial reasons why we should balance our fleet unless we intend to scrap our cargo ships. No one denies that the freight rates are now too low to offer a sufficient inducement for capital to invest in shipping but, on the other

hand, there has been no reduction in first class passenger fares. It is safe to say that the *Olympic* has been netting over two hundred thousand dollars a round trip up to November and that the *George Washington* on one trip, at least, gave a profit of $100,000. The naval architect of one of our steamship lines shows on page 7 of this issue what could be done with the *Agamemnon* and *Mount Vernon,* if they were properly reconditioned. Wake up America! for what is done during the coming year will probably determine whether or not "Old Glory" shall take its proper place on the "seven seas."

Lightships and Lighthouse Tenders

SECRETARY HOOVER in his annual report emphasizes the immediate need for an appropriation for the construction of sixteen new lightships and eleven lighthouse tenders. As it takes from two to three years to get these vessels into commission after an appropriation is made, the urgency of prompt action on this matter cannot be too strongly advocated.

The report gives us the astounding information that twelve of the lightships are over fifty years old and that the average age at the present time of the lighthouse tenders is twenty-one years and the light vessels thirty years. There are now in active use nineteen lighthouse tenders that are over twenty-five years old and twenty-three lightships that are over thirty years old. Of course this deplorable condition is largely due to the concentration on merchant work during the war but, aside from this, there has been a large increase, amounting to 40 percent, in the number of aids to navigation that have to be maintained.

There can be no question of the necessity and importance of the work that the Lighthouse Service is doing in safeguarding both life and property. The loss of one ocean liner through a breakdown in this service would more than offset in property value, to say nothing of the loss of lives, the entire cost of the twenty-seven vessels that are urgently needed. Sooner or later such a catastrophe is bound to occur, if we continue to rely on these antique ships to perform the extra hazardous duty and to navigate in the shoal waters that this service requires.

That this department of the government has continued to function efficiently in the face of such a handicap in equipment must be credited to a splendid personnel, and it is therefore all the more shameful to require the officers and crews to continue to risk their lives in these old vessels which navigate in waters that every other ship takes good care to avoid.

However, from a practical business point of view there is no advantage in retaining in service any vessel after it has reached a reasonable limit of usefulness. There is a greatly diminished output of work and a rapidly increasing cost of upkeep and operation. The cost of repairs and the continual overhauling are sufficient reasons to construct new vessels, but when we have added to this the fact that the shipyards are anxious and willing to build these vessels at much lower prices than it has been possible to obtain for years, or are likely to occur again, there is nothing to be gained by waiting for a serious accident to stir us into action.

Ship Breaking

ONE of the immediate results of the Disarmament Conference will be the starting of a new industry in this country which in England is called ship breaking. It is estimated that there are between 400,000 and 500,000 tons of warships that must be scrapped and the problem is to salvage the material, machinery and equipment contained in these vessels. If this can be done successfully, there are millions of tons of obsolete and inefficient merchant ships which must, sooner or later, either be scrapped or taken out on the ocean and sunk.

However, without reference to the merchant vessels and relating solely to specific warships, a conference under the auspices of the Navy Department was held at the League Island Navy Yard, Philadelphia, on December 16. Representatives from shipyards, steel companies, scrap dealers, financial organizations, the Navy Department and trade papers attended. It was hoped that the conference would bring out a discussion of the national importance of the problem and the desirability of establishing ship breaking concerns in this country but no one volunteered any information of a nature that gave any light on the financial possibilities of the business.

Mr. J. G. Hitner of Philadelphia did say that he had been engaged in this line of work for several years and had been successful at it. He recommended that the Navy Department should require a high enough deposit from the bidders to eliminate all but reliable concerns and that it would not be fair for a company to submit the amount that it was willing to pay for a ship and thus expose its hand unless the highest bid was accepted whether or not it fell below what the Navy Department considered the ship was worth.

Representatives from companies which produce gas for cutting stated that there would be no trouble in cutting through armor but did not give any figures upon which estimates could be made. The whole meeting gave one the impression that while everyone was interested nobody had any intention of giving any information that could be of possible use to a competitor.

The presence, however, of shipyard representatives suggested possibilities for the utilization of plants where the equipment used in erecting a ship might also be used efficiently to break it up. Shipyards located in districts where transportation of the salvaged material to the market would not be too high should, with the equipment at their command, be in a far better position to handle this work than a dealer in scrap metals.

The question is, are the ships to be stripped of their brass fittings and such equipment as may be easily removed and then towed out to sea and sunk or are they to be salvaged to the greatest possible extent, even to cutting them to pieces with the gas flame? There are several thousand tons of structural steel in a ship of ordinary size. Is it possible for a yard with the proper equipment to break up this material cheaply enough to make it profitable as a business proposition? If it is, then we should not overlook the possibilities of the ship breaking industry, for there are millions of tons of vessels afloat today which should be broken up.

The Future of Our Merchant Marine

Restored Normal Prosperity in America Must Be Based on Foreign Trade and We Can Not Rely on Others to Carry Our Products

By "Old Scotch"

OUR ocean shipping, our shipbuilding and all our allied interests are in a very critical position. Never before in our history have these industries, so vital to our national well-being, faced such a dark outlook as at present.

Those requirements for the Jones law, which are supposed to be ample to protect our foreign shipping from the relentless rivalry of other nations, are not to be enforced. The reasons given by our executive for his failure to enforce these sections intended to establish our merchant marine permanently are evidently sufficient to his mind to warrant his declining to act, although it is strange, according to his own statement, that the much dreaded retaliation has not been even hinted at officially by any of the interested nations. Possibly it is due to causes with which it is not advisable to acquaint the public. Hence relying on his already demonstrated intensely patriotic interest in our merchant marine, it will avail naught to carry the inquiry further. What, then, awaits us? What hopes have we who with abiding faith have looked confidently to the future renaissance of our merchant marine?

A Straight Subsidy

In an article appearing in this magazine one year ago, the writer then expressed himself that after all is said and done the one sure remedy for our shipping ills is a straight-out subsidy, or, as Chairman Lasker recently expressed it in a public utterance, "a subsidy without synonym."

The President has already stated that early in January he will make a special appeal to Congress for a sufficient subsidy to enable private owners to operate our ships in the open rivalry on the seas. It is entirely unnecessary to try and convince the readers of this magazine of the national benefit of a subsidy to our ships in the foreign trade. Every one connected either directly or indirectly with shipbuilding or ship operating knows full well that it must come to pass, else our hopes and ambitions on the seas will perish ignobly. It is therefore the duty of each and all of us, who are thus interested, to constitute himself as a merchant marine evangelist and by every means possible and at every opportunity to preach the doctrine of governmental aid to those who are ignorant of the benefits of a nation's shipping to the general well being of all. In the offices, the shops, the railroads, the clubs and in the highways and byways, wherever you find a citizen and a voter needing enlightenment on this all-absorbing topic, go at him with an array of facts and arguments, so that he too will become enlightened and interested. The campaign must be intensive and far reaching. Do not overlook anyone; the further they live from the seacoasts, the more intensive should be *your* efforts.

President to Recommend Method

The executive has promised that he will endeavor to recommend a method whereby the money necessary to carry out his ideas will not be taken directly from the pockets of the already sorely tried taxpayer. Let us hope that the methods recommended will be such, as we know from past history of similar endeavors that anything which savors of governmental help to any particular industry will have a rocky road to fruition. The average congressman or senator looks askance at any such proposal and it is only the pressure from their constituents which will gain their support. It is well, therefore, for those of us who are interested to rehearse and fortify our arguments, which we know full well are logical and just.

In the writer's opinion the whole subject should be approached on the broad lines that a subsidy is another form of a protective tariff, no more and no less. In a new country such as ours, possessed by divine grace of enormous natural resources in field, forest and mine, it was but natural that in our early days we devoted ourselves to agricultural and mining pursuits and received our manufactured goods from the lands of our forebears, where, through the centuries of their development, such branches of industry had become thoroughly and efficiently established.

As our nation grew, and huge centers of population developed, many of our citizens began to look for a livelihood to sources other than those of the established elementary vocations. Whatever your politics may be, you must admit, as history has proven, that the great manufacturing interests which we now possess have been made possible by adopting the principles of the protective tariff in the earlier stages of development. The pioneers in any branch of manufacturing were confronted by lack of experience and by the higher standards of living which had, owing to our great national resources, become fixed in our customs. Almost any of the long list of goods, which our factories and mills now produce so successfully, would have been impossible of production here if the pioneers had been compelled to produce them in open competition with the long established plants in Europe. The 3,000 miles of water which intervened was in itself a barrier directly in proportion to the fluctuating costs of ocean freights, but that in itself was by no means sufficient.

Hence, in many instances protective tariffs ofttimes as high as 40 to 50 percent were established to aid these infant industries. As they gradually developed, and American skill and enterprise were applied to the methods of manufacture, many of the most important of them have reached a position whereby it is possible to produce the goods at home, without the necessity for any tariff to protect them. Notably among these is the great steel industry, developed from nothing until today we manufacture more of that highly essential product than all the other nations of the world combined.

Our Foreign Shipping an Infant Industry

Our shipping in the foreign trade today is an infant industry, exposed to the most intense rivalry of other nations, strongly entrenched by many years of experience and having much lower standards of living with consequent lower costs of operation. It does not even have the benefit of the protection of 3,000 miles and more of water surrounding our continent, for just one league from our shores the ships of all the world have an equality of opportunity. Basically and naturally, therefore, our shipping in its present early state of development must have the benefit of governmental protection, as all our other great manufacturing industries have had. A subsidy to ships is the indirect and only way of effectively applying the principle of a protective tariff on the seas.

Why is it necessary to have our own ships, and why not let foreigners, who specialize in sea-carrying and can do it for

less than ourselves, have the business, asks the unthinking?

The same inquiry could have been, and probably was, made concerning the steel industry, the tin-plate industry, the clothing industry or in fact any of our industries other than agricultural or mining pursuits.

The answer to any of these questions might be: Very well, if we all want to be and can be miners, farmers or lumbermen let foreigners do all of these things.

But we have reached a state in our national development where our manufacturing output exceeds our agricultural output. Further, we are producing much more manufactured products and farm products than we consume among ourselves. No business is successful unless it sells all its output. If Henry Ford manufactured 1,000,000 of his justly famous "flivvers" every year, and could only sell 850,000 of them and annually had 150,000 left on his hands, he would soon be a bankrupt and would not be figuring on buying railroads and nitrate plants.

In other words, we have to export our surplus products, amounting to 15 percent of our output in factory, farm and mine to be successful as a nation. To prevent our "flivvering" as a nation, these surplus products must be transported over the water and sold to other nations. Many of these other nations have excess products of the same kinds which they too must sell across the waters and what is more, they have their own ships in which to carry them.

Foreign Ships Will Give Preference to Their Own Products

Now, let us presume that our generous rivals will be glad to carry our goods to these same markets, where they wish to sell their own products in competition. You can have one guess, as that is all that is necessary, as to whose goods will be sold first. Just now, in this period of depression, if some magnate in Madagascar or other outlying place should even indicate that he wanted to buy ten locomotives, or a 1,000 tons of wheat, he would be deluged with offers. If we had no ships of our own, who do you imagine would get these orders?

It is all very well for foreigners to cut rates for carrying our goods overseas, when they know we have our own ships in which to make deliveries, but suppose again we had no ships of our own, what do you suppose the rates would then be, when it came to competitive selling overseas?

Merchant Marine a National Asset

A good, large merchant marine with all that goes with it would be a national asset, even if all our vessels were tied up to wharves or at anchor in our own ports in readiness to be operated. It would be worth millions of the public funds to protect us in our endeavor to dispose of our surplusage.

Having ships of our own is like having money in the bank. If a man has a good bank account, he can borrow funds very readily, but if he goes broke, no one will even look at him when he needs more funds.

Fifty years ago our foreign rivals had to have our food and minerals, but they do not have to buy our manufactured products and our farm products today, unless we make it attractive to them to buy from us. Hence every citizen of this country is either directly or indirectly interested in the maintenance of our own delivery system, exemplified by our sea-going merchant ships.

Now, how can this necessary subsidy be paid without further crimping the taxpayer's pocket? The answer seems simple enough.

During the late war and immediately following it, we spent about three and a half billions of dollars to create an enormous fleet of ships as a necessity of the times. In the minds of the public that sum has been marked off, along with the billions spent for battleships, ammunition, pay of soldiers and salaries and other sacrifices to the demon war. We were drunk and now we are going through the morning after.

Sell the Ships with a Subsidy

We could not sell these merchant ships today for much more than a half billion dollars, if that much, because under existing conditions it is not profitable for private owners to operate them under the American flag. If Congress grants a subsidy of say $50,000,000 as a protective tariff to our shipping industry, the sale value of the fleet would be doubled. Therefore sell the ships and out of the money obtained (already charged off in the minds of the public) pay the subsidy.

At first glance it looks like a bootstrap proposition, but think it over; the more you think about it, the better it will look to you. Keep also in mind the steel industry in this country, and of how by American methods it has progressed in a comparatively short time to a position where it no longer has to be coddled.

No shipping, no shipyards, is axiomatic. Therefore it behooves us all in either of these industries to get busy with our arguments for this subsidy legislation. We must succeed, or else we had better begin to study agriculture, and I know that shipping men make poor farmers.

Twelve Percent Increase of America's Merchant Marine Reported by Commissioner of Navigation

The annual report of the Commissioner of Navigation shows that on June 30, 1921, the American merchant marine comprised 28,012 vessels of all kinds of 18,282,136 gross tons, an increase over the preceding fiscal year of 1,958,114 gross tons, or 12 percent.

Of this amount 5,951 vessels of 11,077,398 gross tons were in the foreign trade, 21,478 vessels of 7,163,136 gross tons were in the coasting trade, and 583 vessels of 41,602 gross tons in the fisheries. The tonnage of vessels registered for the foreign trade is almost eleven times larger than in 1914.

There were 1,361 vessels of 2,265,115 gross tons built, 380 vessels of 183,209 gross tons lost and 212 vessels of 116,572 gross tons sold to alien flags during the year.

It is interesting to note that the average gross tonnage of a merchant vessel in 1868 was 154, in 1920 it was 579, and in 1921 it was 652.

The number of officers, below the grade of master, and seamen shipped and reshipped on American vessels by shipping commissioners was 325,832, of which 48.3 percent was American. The total number shipped, reshipped and discharged by shipping commissioners and collectors of customs was 707,206.

The use of radio on American vessels has increased rapidly since 1914, when there were 555 vessels equipped, compared with 2,978 in 1921, an increase of 437 percent.

The total number of radio stations of all kinds, with the exception of amateur receiving stations which are not required to be licensed, was 10,355 in 1920 and 12,258 in 1921.

Steamboat Inspection Service Activities.—During the fiscal year ended June 30, 1921, the Steamboat Inspection Service inspected and certificated 8,095 vessels with a total gross tonnage of 16,231,001, of which 7,753 were domestic vessels with a total gross tonnage of 13,139,630, and 342 were foreign passenger steam vessels with a total gross tonnage of 3,091,971. Of the domestic vessels, there were 6,437 steam vessels, 716 motor vessels, 15 passenger barges, and 585 seagoing barges.

Great Britain and Her Subsidies

A Lesson for the Law Makers of the United States—America's Need for Subsidized Shipping

By Winthrop L. Marvin

ONLY in the United States are shipping subsidies ever debated. Elsewhere they are accepted as a matter of course. A dozen years ago $47,000,000 was being annually expended by the nations on the fostering of their merchant marines. Now the sum is unquestionably greater. The imperative need of merchant ships and seamen has been a thought indelibly burned into human consciousness by the great world war.

Of this $47,000,000 expended for shipping subsidies by the nations of the world in 1909 and the years immediately thereafter, about $1,000,000 in a few postal contracts was the contribution of the United States. The richest of all countries was giving less to its merchant marine in this way than Canada ($1,581,000), one-third as much as Spain ($3,150,000), less than one-third as much as Italy ($3,872,000), and less than one-fifth as much as Japan ($5,413,000). France was then paying $13,423,000 a year in subsidies and Great Britain and her colonies nearly $10,000,000. It is Great Britain that has made the first and most successful use of shipping subsidies—and that notwithstanding their obvious conflict with her contemporaneous policy of free trade, now being quietly abandoned.

Cunard Line Created by Postal Bounty

British ocean subsidizing dates back more than eighty years to the postal bounty of $425,000 a year, which in 1839 created the Cunard line of transatlantic steamers. There quickly followed other and larger subsidies to the Peninsular and Oriental, the Royal Mail, the Pacific Steam Navigation Company and other new services to all quarters of the world. These early British subsidies did more than merely to create and sustain steamship communication. They contributed powerfully to the aid and development of steamship building and engine building in the era when the art was new. These subsidies were paid to liners when all steamships were liners, but after a while the shipyards which the subsidies had fostered were launching "tramps"—for it is the unfailing experience with liner subsidies that they develop commerce, which soon demands slower and cheaper cargo vessels for the carrying of its cheaper and bulkier cargoes.

Great Britain never made a more profitable investment than her several hundred million dollars of steamship subsidies from 1839 to 1921. These subsidies put behind the Cunard and other British steamship services of that kind the entire power of the Imperial government and made British steam shipping the most effectively protected industry in existence.

The Early British Subsidies

It is well for Americans, facing the same problem that confronted their kinsmen so many years ago, to take some note of the character and purpose of those earlier British subsidies. These are clearly and authoritatively stated by the Parliamentary Committee on Ocean Mail Contracts, through which British subsidies were first extended. Those lawgivers of 1840-1850, who framed the contracts and perfectly understood their nature, declared:

> "The objects which have led to the formation of these contracts and to the large expenditures involved were to afford us rapid, frequent and punctual communication with distant ports which feed the main arteries of British commerce and with the most important of our foreign possessions, to foster maritime enterprise and to encourage the production of a superior class of vessels which would promote the commerce and wealth of the nation in time of peace and assist in defending its shores against hostile aggression."

Merely substituting "American" for "British," President Harding might well cite these words of the Parliamentary Committee defining the character and purpose of British subsidies as the preamble of his shipping bill of 1921!

In 1909, and in the other years just before the world war began, British postal and admiralty subsidies to steam lines, retainers to naval reserve officers and men and similar assistance to merchant shipping amounted to a very substantial encouragement to shipbuilding and navigation. "In effect the Admiralty contracts," declared the report* of the British Tariff Commission in 1909, "constitute a rigid system of protection," particularly "to the British engineering and shipbuilding industry." And again, quoting from this same authoritative report, "Engineering and shipbuilding derive other considerable advantages from Government subsidies and Government mail transport and other contracts given to various British shipping lines. During the past ten years the government money which has passed into the hands of British steamship companies in respect of these and similar services has amounted to nearly £2,000,000 per annum."

It was with the historic facts about British steamship subsidies in mind that Mr. Blaine, in his celebrated debate over free trade and protection with Mr. Gladstone, declared:

> "It will not escape Mr. Gladstone's keen observation that British interests in navigation flourish with less rivalry and have increased in greater proportion than any other of the great interests of the United Kingdom. I ask his candid admission that it is the one interest which England has protected steadily and determinedly, regardless of consistency and regardless of expense. Nor will Mr. Gladstone fail to note that navigation is the weakest of the great interests in the United States, because it is the one which the National Government has consistently refused to protect!"

Mr. Gladstone never made any effort to reply to this—he could not answer. As one of his own contemporary public men, Henniker Heaton, Postmaster General of Great Britain, said:

> "As American ships were not subsidized, their owners could not compete with the Cunard and other companies, the art of shipbuilding languished, and the American carrying trade was transferred to foreign bottoms. In 1891 only 13 percent of the exports from the United States were carried in American ships, which at one time had engrossed 90 percent."

All this is historically true and accurate—and strikingly true and just also is the further declaration of the British Postmaster General that:

> "As a consequence of refusing $5,000,000 a year in subsidies during thirty years to native shipowners, or $150,000,000, the United States had to pay in the same period not less than $3,000,000,000 for freights, while their mercantile marine dwindled into insignificance."

American Subsidized Ships Led Their Competitors

So long as British subsidy was matched by American subsidy on the North Atlantic, the advantage was overwhelmingly in favor of the Stars and Stripes. Though the British had started with the first Cunard steamers in 1839, the granting of mail subsidies to the Collins and other American lines wrought an immediate and great increase in American steam shipping. As Lindsay, the historian of

*Volume 4, Paragraphs 91, 92.

British shipping, said, "Before the American line was established, the Cunard steamers were receiving £7 10s. per ton, freight, which was so much a monoply rate that in two years after the Collins Line had commenced the rate of freight fell to £4 per ton." Moreover, the American liners, with their larger size, higher speed and more comfortable service, quickly won the best passenger trade away from the Cunarders, to such an extent that between January and November of 1852 the American ships on the route between New York and Liverpool conveyed 4,306 cabin passengers to the 2,969 of the Cunard Line. In vain the British government increased the Cunard subsidy from $425,000 to $856,-000 a year. The American ships kept steadily ahead, holding all the Atlantic records and commanding the best and most profitable patronage. American ocean steam shipping rose from 5,631 tons in 1847 to 115,045 tons in 1855. As Dr. David A. Wells, the economist and historian, said:

"During the single year 1849-50 we increased our ocean steam tonnage one hundred and thirteen percent, and the seagoing qualities and performances of our vessels were so admirable that the Cunard Company, which had then been in operation ten years, was obliged to bring out new ships to compete with them. The prospect, therefore, at one time was that the United States, although late in the start in this new department of foreign shipping, would soon equal, if not overtake, her great commercial competitor."

American shipping subsidies, in other words, had proved far more effective and successful than British shipping subsidies while the two nations competed on approximately even terms. Two of the Collins steamers were lost because of the hazards of the sea. Several British transatlantic liners were also lost in the same period, the *President* and the *City of Glasgow* vanishing with all on board.

Withdrawal of Subsidies Killed the American Merchant Marine

But what killed the American transatlantic service, before the Civil War, was the withdrawal of the American subsidies in 1856 and in 1858 in the very crisis of the contest between the American and British flags. This action by Congress was due to the bitter animosities of the sectional quarrel preceding the Civil War. But for that ill-starred feud, which cost America so heavily, the Stars and Stripes would have continued to dominate the North Atlantic trade in steam as it long had under canvas.

Great Britain persisted in her subsidizing; the United States did not. That is the entire explanation, just as Postmaster General Heaton has described it, or, to quote the words of a great American shipowner and merchant, an eye-witness of the tragic change—A. A. Low, Esq., of New York, the father of Seth Low, once Mayor of New York and President of Columbia University:

"I only know the English have always, in peace and war, manifested a determination to hold the supremacy on the ocean, and the supremacy which they acquired by arms in war they have in peace acquired by subsidies. They have deliberately and intentionally driven the Americans from the ocean by paying subsidies which they knew our Congress would not pay. I believe it has been the deliberate purpose on the part of England to maintain her supremacy upon the ocean by paying larger subsidies than any other nation, as long as subsidies were necessary to preserve their control. . . . They have driven us from the ocean by that policy just as effectually as they ever did drive an enemy from the ocean by their guns."

History repeated itself in 1903, when, alarmed by the actual fact of German competition and a prospect of American competition also, the British Government gave to the Cunard Company an extraordinary grant of a subsidy of $1,100,000 for twenty years, coupled with a loan of $13,-000,000 at 2¾ percent interest which virtually made a present to the Cunard Line of the giant steamers *Mauretania* and *Lusitania*. This was at once the most liberal and the most valuable and effective subsidy ever given in the history of commerce. It was worth to the Cunard Company far more than its cash value—for it involved a declaration to the world that Great Britain would stand by her shipping lines, sustain them and see them through any crisis of competition whatsoever. Since that time the Cunard Company, gathering in other organizations, has become the chief of all British steamship companies—to all intents and purposes the British government afloat.

British Shipping Backed by the British Empire

It may be urged that it has not been the British policy to give subsidies or bounties to ordinary cargo steamers. But cargo steamers and liners have been in effect protected by the world-wide knowledge that the whole resources of the British Empire were at the call of the mercantile marine, and by the complete world-wide organization of British shipowners, agents, brokers, merchants and bankers, which provides a certain preference for British merchant ships, whether they be "tramps" or liners, in all the waters of the globe.

Neither America nor any other rival has any right to quarrel with British policies toward British shipping. They reflect prudence, patriotism and common sense. British statesmen have never been troubled by any little thing like dread of inconsistency. They have had free trade for manufacturing because they believed that it was to their advantage to have it. They have maintained protection through subsidy and in other ways for shipping because they knew that it best served their interests. They are heartily to be commended for so doing—and America will be commended if she has the wisdom and courage to follow the British example in administering vigorous protection wherever it is needed for the promotion of the United States merchant marine.

Subsidy for American Vessels Urgently Needed

America needs subsidy not only for her liners but for her cargo ships, because the most of the war-built tonnage of the Shipping Board consists of cargo ships pure and simple. As conditions now are, with the whole world over-steamered, these American cargo ships cannot be put into service and kept in service in competitive overseas trade unless, like the liners, they are also sustained by the protection of the Government of the United States. Cargo ships under our flag must have this protection because, assuming even the wisest amendment of the La Follette seamen's law, they must have compensation for their higher wage and living standards and costs of maintenance.

These higher costs are not due in any great degree to navigation laws and requirements—though so far as possible these navigation laws and regulations must be changed and modernized. These higher costs of American ship wages and maintenance existed long years before the enactment of the La Follette law. They would exist if that law were totally abolished. They are fundamentally due to the higher wages and standards of living that prevail among American workers on land, by which, and not by statutory law, sea wages and standards of living are established. There are the same reasons for protecting American cargo ships as there are for protecting American factories and farms—and the cogency of these reasons is not seriously questioned at any time by any considerable proportion of the American people.

Moreover, America is a country of heavy export cargoes. Its staple products of agriculture, mine and forest are relatively bulky materials. They demand and justify particularly the very active encouragement of cargo ships to convey them to the markets of the world.

With these conditions in mind there is no justification for withholding from our shipping the same protection that has given life and prosperity to our other industries.

Economics of Operating Reconditioned Liners

Figuring Revenues at a Minimum and Expenditures at a Maximum, the Mount Vernon and Agamemnon Could Be Operated at a Profit

By Carl E. Petersen

ONE hears so much nowadays concerning our inadequate representation in the North Atlantic passenger service coupled with the fact that a number of large ex-German liners are laid up at their docks after strenuous war service with no apparent definite policy as to their reconditioning and with few prospective buyers that it is thought that an estimate of the possible economics of two of these vessels, the *Mount Vernon* and the *Agamemnon,* would be interesting and a subject of profitable discussion.

These vessels, formerly the *Kronprinzessin Cecile* and *Kaiser Wilhelm II,* were for a time the largest and fastest passenger vessels in the transatlantic service and they had the reputation of being very profitable to their owners. Of course, it is realized that economic conditions with respect to steamship operation have changed greatly since pre-war times.

Particulars

Length over all	706 feet 6 inches
Length between perpendiculars	680 feet 4 inches
Breadth	72 feet 0 inches
Depth	44 feet 2 inches
Gross tonnage	19,503
Net tonnage	6,589
Mean draft	31 feet 6 inches
Average speed at sea, knots	22.4
Mean indicated horsepower	43,000

Service

For the purpose of these notes it is assumed that the vessels will be used to maintain a high speed transatlantic passenger, mail and express cargo service between New York and Bremen via Plymouth and Cherbourg.

Fuel

While these vessels at present use coal for fuel it is well recognized that in vessels of this size, type and power the additional operating expense, principally due to the larger fire room personnel required, delays in coaling, together with a loss in passenger space, would preclude the use of coal for fuel from an economic viewpoint. The use of oil as fuel would also increase the revenue from mails and express cargo and it would have the advantage of cleanliness. Therefore, the conversion from coal to oil is included in the total estimated cost of reconditioning.

To maintain an average speed of 22 knots and allowing 1.1 pounds of oil per indicated horsepower hour the fuel consumption per day would be 510 tons or not quite one ton per mile. Figuring the voyage one way at 3,900 nautical miles and allowing six lay days in port at 40 tons per day it will be seen that 4,140 tons of fuel are required. This capacity can be obtained in these vessels in the arrangement which at one time was contemplated. Fuel oil delivered is figured at $15 per ton or about 30 percent higher than the prevailing price at New York to allow for the higher price in Europe.

Passengers

Passenger revenue is based on a 75 percent capacity of 680 first class, 330 second class and 620 third class figured at minimum rates of each class, viz., $275 and $250 for first class high and low seasons, respectively, and $140 for second class and $103 for the third. When it is considered that previous to the war the demand for passage on these vessels exceeded the accommodations during the high season by 33 percent and equalled 75 percent of the capacity during the low season, the percentage used for an estimate is moderate. With excellent accommodations for all classes, equal or superior to competitive vessels, actual rates will exceed the minimum ones. No revenues from bar sales, steamer chair hire, confectionery, etc., are included in this estimate.

All figures are based on 12 round trips per year maintaining a 28-day schedule with one month lay up during the winter for annual overhaul. This schedule will allow more than ample time in port and by reducing the stay in port 13 round trips per year could easily be made should it be desired.

Subsistence is figured at $2 each per diem for first class passengers, $1.50 each per diem for second class, and $1 each per diem for third class and crew.

Express Cargo and Mail

	Tons
Weight of ship light	20,000
Water in boilers	800
Fuel oil	4,140
Fresh and feed water	1,600
Passengers, crew and stores	415
Mail, 6,000 sacks at 50 pounds each	135
Express cargo	600
Displacement at 31 feet 6 inches mean draft	27,680

Express cargo is figured at a nominal figure of $10 per ton per trip. The actual revenue will be largely increased because it is customary to rate express cargo by the measurement ton and the cubic is available in these vessels. However, the figure given will suffice for an estimate.

Mail carried without special contract is usually conveyed eastbound at a rate of 80 cents a pound for letters and post cards and 8 cents a pound for other matter and westbound at about 35 cents and 4½ cents respectively. For the purpose of this estimate mail is figured roughly at $5 per sack eastbound and $2 per sack westbound, allowing 6,000 sacks eastbound and 1,000 sacks westbound.

Annual Revenue per Vessel

Passengers		
1st class 680—75%—@$275 x 13 one way trips	$1,823,500	
1st class 680—75%—@ 250 x 11 one way trips	1,402,500	
2d class 330—75%—@ 140 x 24 one way trips	831,500	
3d class 620—75%—@ 103 x 24 one way trips	1,149,500	
	$5,207,000	$5,207,000
Mail		
6,000 sacks @ $5 x 13 one way trips	$ 390,000	
1,000 sacks @ 2 x 11 one way trips	22,000	
	$ 412,000	412,000
Express Cargo		
600 tons @ $10 x 24 one way trips	$ 144,000	144,000
Gross revenue		$5,763,000

Annual Expenditures per Vessel

Fuel—99,600 tons oil @ $15	$1,494,000	
Wages, officers and crew	453,500	
Feeding passengers and crew	512,500	
Equipment, water, lubrication and stores	165,000	
Repairs	240,000	
Insurance	90,000	
Rental of terminals, stevedoring and handling, port charges, towage, advertising, administrative, and sundries	980,000	
Total expenditures		$3,935,000

Capital Expenditures

	S. S. Agamemnon Built 1902	S. S. Mount Vernon Built 1906
Purchase price "as is"	$ 800,000	$1,100,000
Cost to recondition	2,200,000	2,000,000
Capital invested	$3,000,000	$3,100,000
Depreciation	600,000	344,000
Interest on investment, 6 percent	180,000	186,000
Capital charges	$ 780,000	$ 530,000
Gross revenue	$5,763,000	$5,763,000
Gross expenditures and capital charges	4,715,000	4,465,000
Balance after deducting expenditure and capital charges	$1,048,000	$1,298,000

Depreciation

Depreciation is charged off in this estimate at a flat rate of 20 percent and 11.1 percent yearly for the *Agamemnon* and *Mount Vernon*, respectively, for the reason that the prudent steamship owner would no doubt have the invested capital written off by the time the vessels are 25 years old. In this way rising costs of operation due to age could be offset by the absence of capital charges and the vessels show a profit for some years to come.

Interest

Interest on the investment is taken at 6 percent per annum on the decreasing book value of the capital invested.

Conclusion

Revenues are estimated at a minimum, expenditures at a maximum and reasonable factors and values are used throughout. From the estimated balance it will be seen that the reconditioning and profitable operation of these vessels is not a hopeless proposition. The fact that passenger fares have remained at the peak while freight rates have scraped the bottom shows that the supply is not greater than the demand as far as passenger ships are concerned. It would seem that a million dollar profit per annum on an investment of $3,000,000 in the most stable department of ship operation would attract the attention of even the conservative element of the investing public.

American Ships Now Operating on Economical Basis

Experienced Ship Operator Outlines Savings Already Accomplished—Overhead, Stevedoring, Manning Schedules, Wages and Subsistence Reduced

By Robert E. Annin

WHETHER freights have reached bottom at present or whether they are destined to go still lower may be a matter of opinion. Surface indications point to at least the *relative* maintenance of the present level of rates, i. e., that freights can only decline further, if, and when, a decline in the level of operating costs shall have become established. The progressive and worldwide laying up of tonnage clearly indicates that (at least under present cost scales) the operating dead-line has been reached.

American operation has been the most expensive in the world, due to causes which have been thoroughly exploited and which it is not necessary to detail here. Some of these causes still persist and are likely to do so for some time. Others have been due to the inflated psychology of the years 1915 to 1920. This has affected all nations greatly; but has had, perhaps, a particularly marked effect here, owing to the greater proportion of new operators and the almost unlimited demands of American labor during the war emergency. A certain American impatience of small economies may also have been a special factor in our operating costs. In ship operation this latter factor would chiefly affect the inexperienced, since trained operators of every nation know the imperative need of the closest economies in every department of their business. In close competitive times there is no such thing as an "unimportant" economy.

Among the larger expenses of war time, the item of swelled salaries ashore was notable. When freights were at their peak, for instance, salaries of $10,000, $15,000 or $20,000 were not uncommonly paid by concerns which were operating only small squadrons; and every old organization found its personnel constantly threatened by the bidding of new "operators" for their most promising young men. All this, of course, reacted upon the whole salary level for department heads and managers; making the shore end of operation here enormously higher than abroad.

For minor positions (assistants, clerks, etc.), our level has always been much above the European; and this class of office workers profited largely by the inflation of the war and afterwards. Chiefly for these reasons, new and small organizations here frequently ran office expense schedules up to $100,000 or more per year—a scale of expense unknown in this class of firm abroad, even in the times of highest freights.

Shore Expenses of English Shipping Firm

In this connection, the yearly statement of an English shipowning company for the year 1920 seems quite pertinent and affords a striking contrast to the shore operation of many war-time concerns on this side.

The corporation in question showed capital and reserve of £700,000 and assets of about £1,050,000; indicating (on the basis of ruling values even at the end of 1920) a very modest fleet. The gross operating earnings were £145,000; a not surprising figure when the freights ruling in the early part of the year are considered. The main items against earnings were repairs and general maintenance of steamers, about £37,500; and an income tax of £39,000. But the most striking items in the statement are the following:

"To business expenses, including management and rent	£3,076/12/4
"Directors' fees	991/ 0/3
	£4,067/12/7

or say $16,000 shore expense for the management of $4,000,000 of shipping property—4/10 of one percent for shore management and under three percent of gross earnings for management and rent, including directors' fees. In the year 1920 it is a safe assertion that few firms of the same class in America were getting through on less than three times these figures. Of course the extravagant shore expense of the boom times is now a thing of the past. The high rents and salaries and the general disregard of economy, here and abroad, have stopped.

It was obvious from the first that, when the inevitable collapse should occur, such a condition would be the first to cure itself. The failure of some firms, the voluntary re-

tirement of others and the inevitable cutting down of office force by the remainder have already reduced salaries to something like a pre-war basis for all except absolutely essential men. This process is likely to continue until the men displaced by lack of business have had time to disperse into other occupations. The times when it was necessary to offer $12,000 to secure a $4,000 traffic man seem very far in the past, yet this was approximately the case a little over two years ago.

This has been the first great American economy introduced since the slump; it has come very close to being universally practiced, from stenographers to managers. It is not necessary to speak of partners and proprietors who find themselves living on their own savings, or in vulgar phrase, "sucking their paws."

In normal times the shipping business pays high salaries to only a very small proportion of office personnel; certainly not a larger proportion than other trades. Clerical aid earns no more money in shipping than a similar quality of service commands elsewhere. But during the boom freights the pay of every branch of service, afloat and ashore, showed an inflation that was simply staggering to oldtimers, trained in the economies of 1901-1910. Here, then, is one recent disadvantage of American operation that is rapidly lessening by mere force of economic pressure. The result is inevitably a very material reduction in the per ton cost of handling tonnage from the shore end. That is to say, the reduction of exaggerated salaries means an increased efficiency per unit of expense.

Loading and Discharging Costs Reduced 50 Percent

One might speak here of a similar improvement in conditions "along the beach," as relates to loading, discharging and wharf work. These were almost incredible at one time and certainly cast a valuable direct light upon the contention that high wages produce efficient service. Those whose duties called them to the wharves when wages were at the highest usually came away confirmed in the old conservative belief that such a contention merely confused cause and effect. Since the arrival of hard times, however, "the beach" has gone a long way back toward normal. With the decline in wages and increase of unemployment has come an increase of efficiency which has reduced loading and discharging costs by certainly over 50 percent. To the average man, the fear of losing his job is the only sure incentive to diligence and efficiency. This, however, so far as it concerns either American or foreign ports, applies to all ships equally and is therefore no *relative* gain as between rivals.

Turning to the marine department of operation, operators have been working most keenly, consistently and intelligently to reduce the admitted handicaps under which American ships have heretofore labored. Owing to causes generally recognized, ships privately owned have some advantages over those handled through Government agencies. It is therefore from the private owners that the most marked progress should be expected in important (and even vital) operating economies.

During the boom freights, and owing to the scarcity of efficient men in all ratings, the American ships carried a larger personnel than any rival except the Japanese. Our wage scale was also much higher. Hence, on the face of things, the American expense for wages and subsistence was enormously higher than that of foreign competitors, amounting at times to nearly double that of the English and Norwegians on vessels of the same class. In this result the depreciation of foreign currencies was the chief factor. A German ship (for instance) was reported arriving at Philadelphia last August, with the master drawing a wage of only 2,000 marks a month—then equal to $25.

The effect of this condition, added to others, was such that the American had either to retire from the competition (at least temporarily) or find some way by which his payroll might bear a reasonable relation to that of his chief rivals.

Temporary Withdrawal of American Ships

So far as the occasional business is concerned (i. e., tramp charters), it is evident that most American owners, including the Emergency Fleet Corporation, chose the first course. This is a fair inference from the fact that a leading freight broker's report (from September 1 to December 1, 1921) shows from American ports about 471 outward charters, of which only about 30 were American. (These figures are not necessarily exact but are sufficiently so for any use which is here made of them.) This is for business out of North American ports, excluding United States coastwise trade, which is, of course, protected.

Now, considering that a large part of tramps arriving here come in ballast *"seeking"* (for our deep-sea trade has never been a balanced one) it is clear that, if we can only retain six or seven percent of our business when our foreign rivals bear the waste of coming to us, we cannot hope for success, if we bear the waste of going to them, as for instance in attempting to compete for the export trade in English coal.

It seems therefore a fair statement, based on these facts and considerations, that the record of the past few months indicates the temporary withdrawal of American tonnage from the "full cargo" market.

There remain, however, the line services, private and Governmental (established, unestablished, and incubating), which cannot in the nature of the business withdraw and re-enter as conditions fluctuate. It is among these that we should look for the results of continuous consistent effort in operating economies aboard ship; and it is there, in fact, that we find the greatest progress in such direction.

Of these economies, in view of the inflated conditions from which we are now emerging, the payroll is among the most important. So far as higher ratings are concerned, every line operator strives to retain those licensed officers who have made good, knowing from experience that to keep changing this class of employees for the sake of any small immediate saving is one of the greatest of extravagances. Like every other human aggregation, licensed officers have their share of incompetents and worse. One of the tramp owners' great difficulties is the constant drift of the best officers toward the steadier and more permanent liner services. On the other hand, the line managements, by a continuous process of selection, have the opportunity to build up a personnel which may constitute a most valuable asset; and in pursuit of this purpose the line agent will avoid any policy which would, in the end, prejudice this result.

Selection of Efficient Officers

Under such circumstances no attempt to economize by laying off able officers is likely to result in permanent saving. But the process of selection is made more severe, the incompetent and careless more sternly weeded out and the efficiency thus reached, both on deck and in the engine room, constitutes in itself a most important and permanent economy. No longer need the owner put up with masters who are resourceless at sea and in port, or careless or unsatisfactory in the log books or accounts. The engineer who notoriously spends, personally, more money than he earns officially, and whose fuel accounts are inconsistent and suspicious, is remorselessly replaced by one who has not these eccentricities of genius. In this sense the surplus supply of licensed officers offers a great opportunity for the best and most permanent kind of economy, i. e., the selective upbuilding of an efficient personnel.

In the lower ratings, however, there is opportunity for direct economy both in numbers and pay. The average mer-

chant crew is partly composed of a restless and migratory class whose steadiness cannot be counted on from one voyage to the next, whose avocation is change of berth and whose chief outdoor sport is desertion. So far as this class is concerned no sacrifice of immediate economy to insure permanence is warranted except in the case of individuals.

As to wages, the excess supply of seamen has already greatly reduced payrolls from even last year's level. With bread and butter necessities staring them in the face, many sailors in the lower ratings will accept, and are now accepting, wages which would be very close to the English scale if sterling were at par. Reports of $60, $50 and even $40 berths accepted, for instance, by able seamen are not uncommon. In fact the market is a wide open one and the owner or agent may make what bargain he can with individual seamen. Even the needy trade unionist realizes that half a loaf is better than no bread in these times. So much for the wage situation, per se.

Manning Schedules

Further economies are now being practiced in the cutting down of personnel. An American ship which a year ago carried twelve able and ordinary seamen may now, perhaps, get along with eight; some which in 1920 had ten men and boys in the steward's department will now operate with six. The main difficulty a year ago, when labor was scarce, was that the men would not stand for extra work. Today they will. The saving of wages and subsistence for four seamen in the deck department and two messmen and one utility man in the steward's department may not have sounded very important during the high freight period, but in these days $400 per month in wages and subsistence from such an economy looks quite worth while.

In the engine room the cutting down of force is more difficult, partly because of the attempt to make the engine room force "100 percent American." In an open competition any limiting condition applied to one competitor and not to another is a handicap in reaching the nearest to ideal efficiency. It is *not* for nothing that the thrifty and economical Scot has a world wide reputation as a marine engineer. In the engine room, accounts show the greatest relative economies in personnel, stores, lubricants and, above all, bunkers.

Nevertheless, some of the most up-to-date operators now claim that as to number of personnel they can about match the English crew list on the average, i. e., so far as numbers go they are at no material disadvantage; where they were, only a year since, pulled down by wages and subsistence for five to nine extra men.

Economy in Port

Payroll economy may also be practiced in port whenever outward cargo is not in sight for an arriving ship. In such case the deck and steward's departments can be cut down to a caretaker's basis in the lower ratings. Reduction can sometimes be made in the engine room, but not always, and of course not to the same extent, the engines always requiring more attention, care and tuning up than any other part of the ship.

But deck and engine officers, recognizing the difficult situation of owners under present conditions, will often make special arrangements during a waiting period which materially reduces their pay while in port; a sort of "loss-sharing," which, however, is purely for an emergency. Such arrangement may be presumed to be confined to officers who feel secure of their positions and who, therefore, submit to a sacrifice of personal interest out of loyalty to their line. A sacrifice of this kind is likely to give them a special status for the future. In other words, such action, like most human action, may result from motives more or less mixed.

The matter of subsistence has necessarily received strict attention with marked effect. There is some difference between Kipling's mate of a Cardiff collier who would "eat clinker to save waste" and the post bellum table of a merchant foremast hand which ran into all sorts of excesses from broiling poultry to fruit out of season. The subsistence bills of merchant ships during the war and post-war boom were appalling even to the most inexperienced operators. The causes were partly war inflation, partly inexperienced operators and partly graft.

Cost of Subsistence

In 1913 an English owner expected to feed his crew at from 35 to 40 cents per day per man. In the winter of 1920-1921 the average cost on English ships ran up to $1 per head and of American $1.25, $1.50 and (as is reported in some cases) very much higher. From thence on there has been a steady decline in cost of subsistence on all ships and, as the American was most extravagant in this respect, the decline in American cost has been notably the greatest. From a per capita of at least $1.25 less than a year since, the price had reached $1 by June, 1921; 85 cents by August, and may now fairly be placed at an average of 60 cents. Reported present costs range from 65 cents down to 52 cents per capita, according to circumstances.

Detention of Ships in Port

FIGURES giving the average number of days spent in berth and the average number of days waiting berth by vessels engaged in foreign trade for certain of the large ports in Great Britain are published monthly by the British Board of Trade. From these reports are taken the figures tabulated below which refer to vessels dealt with at the accommodation of the Port Authority named.

By "working day" is meant a complete week day of 24 hours, Sundays and holidays being excluded and parts of a day being dropped. No distinction is made between a vessel which carries cargo only one way and one which both discharges and loads, nor as to the character of the cargo handled. It will be apparent from this that the figures are not comparable as between one port and another, but that within certain limits they are comparable between one month and another at individual ports.

Port and Name of Authority	Month 1921	Number of Ships Departing: Total	Average working days in berth per ship Days	Average delay per ship waiting berth Days
London	July	316	9.04	0.25
(Port of London Authority)	June	289	9.05	0.32
Liverpool	July	299	6.27	0.06
(Mersey Docks & Harbour Board)	June	268	5.80	0.06
Cardiff	July	92	1.76	....
(Cardiff Railway Co.)	June	4	1.00	....
Newcastle	July	63	1.60	0.63
(Tyne Ports) (River Tyne Cmrs.)	June	9	2.67	0.67
Glasgow	July	57	6.04	....
(Clyde Nav. Trustees)	June	50	6.32	....
Hull	July	90	4.71	0.03
(H. & B. Rly & Hull Jt. Dk. Committee)	June	65	4.54	....
Newport	July	65	1.40	0.06
(Alexandra Docks & Railway Co.)	June	2	3.50	....
Swansea	July	30	1.50	0.07
(Swansea Harbour Trust)	June	20	1.65	0.05
Manchester	July	94	5.07	0.06
(Manchester Ship Canal Co.)	June	79	4.80	....
Bristol	July	61	5.44	1.15
(Corporation)	June	51	5.61	....

Railroad Contracts With Foreign Shipping Lines

By Waldon Fawcett

The exclusive or preferential contract between any railroad operating in the United States and any foreign flag shipping company is soon to become a relic of the past. This much may be confidently predicted as the result of a conference held at the offices of the United States Shipping Board in Washington, the first week in December. This conference between the representatives of ten leading American railroads and the Shipping Board Committee on Interstate Commerce Conferences, was the fruit of a spirit of resentment that has lately manifested itself in the Congress of the United States.

THAT element in the national legislature which has given unreservedly of its enthusiasm in behalf of the upbuilding of an American merchant marine was manifestly perturbed, not long since, when it came to the attention of Congress that there were in existence close compacts, or exclusive contracts, for reciprocity in the exchange of traffic between certain American railroad systems and various shipping companies operating vessels of foreign registry. There was animated discussion in the United States Senate as to the propriety of such entangling alliances, and ultimately the Senate "resolved," as it does when a matter of public policy or practice requires investigation.

All that will be necessary, however, to abolish existing international alliances of rail and water transportation interests and to prevent such arrangements in future is repressive action by the Shipping Board. By the terms of the Jones law, or the Merchant Marine Act of 1920, the Shipping Board is clothed with ample authority summarily to sunder the foreign connections of American railroads and this fact is fully appreciated by railroad executives. Indeed, some of the railroad men, moved by the spirit of patriotism or seeing the handwriting on the wall, had already taken steps to terminate existing contracts ere they journeyed to Washington to discuss the situation with the Shipping Board committee consisting of Frederick I. Thompson, of Alabama, chairman; E. C. Plummer, of Maine, and Meyer Lissner, of California.

Conference Has Dual Purpose

Dual purpose was ascribed to the conference. First, the Shipping Board commissioners would examine, by means of first-hand information, into the extent, character and effect of the railroad contracts with foreign shipping corporations. Unless, however, evidence of exceptional character was forthcoming the outcome was foreordained. The Shipping Board committee had devoted weeks of preliminary study to the subject and out of a close inspection of copies of all the contracts and the personal experiences and observations of the three commissioners had been borne a pretty strong conviction that, sentimentally and practically, the existence of such contracts was detrimental to the best interests and the future prospects of the new American merchant marine.

Second of the purposes of the conference was formally to ask of the railroad interests the abrogation or cancellation of these contracts that seem to bid defiance to an expanding merchant marine under the United States flag. It was this phase of the objective that necessarily rendered inconclusive the immediate outcome of the negotiations. There was manifest on the part of some of the railroad men a spirit of ready concurrence in the ideas and the wishes of the Shipping Board committee and on the part of the other railroad delegates the realization that the word of the Shipping Board is law in the premises. But a number of the railroad executives asked for time to consult with their directorates or fellow executives—not so much as to the fundamental act of renunciation as to ways and means of severing relations legally—and accordingly the conference adjourned to await the preparation of formal proposals on the part of the railroads. However, as has been said, whether the process be wholly voluntary or partly compulsory, the outcome is almost inevitable.

Exclusive Contracts Affect Development of Ports

Incidentally it was revealed in the course of the hearings that the Shipping Board committee which initiated the impending "reform" has in prospect a project of even deeper and more intimate significance to the shipping interests of the United States than the severance of foreign alliances. Chairman Thompson dropped the remark that, once this present problem is out of the way, the committee contemplates an investigation of all existing contracts and reciprocal arrangements between American railroads and American shipping interests. He was careful to make it clear that this impending issue is not to be allowed to becloud the current one but seemingly there is a suspicion that anything in the nature of exclusive contractual relations between rail and water lines may not only make impress upon the evolution of the merchant marine but might likewise exert influence upon the development of American ports and the provision of terminal facilities.

Ten American railroads are involved in the international "communities of interest" which the Shipping Board is so strongly inclined to regard as prejudicial to the free fighting chance of an American merchant marine. As shown by the records compiled by the Shipping Board committee the contract distribution covers both hemispheres. The Baltimore and Ohio Railroad has contracts with the Donaldson Lines, Scandinavian Lines and Furness, Withy and Company. It formerly had a contract with the North German Lloyd but this lapsed when the German service to the port of Baltimore was interrupted at the time of the world war. The Great Northern Railway has a contract with Nippon Yusen Kaisha —a contract that provoked the most spirited discussions of the conference owing to the fact that it was renewed in October, 1921, on the very eve, as it were, of the governmental move to bring about severance of relations.

The Pennsylvania Railroad has contracts with the International Mercantile Marine Company and the Pennsylvania's affiliated line, the Northern Central Railroad, has engagements with the International Mercantile Marine and Furness, Withy and Company. The Southern Railway Company and the Mobile and Ohio Railroad each have contracts with the Mobile Liners, Inc. The Boston & Albany Railroad is accredited with contracts with the Leland Steamship Lines and Cunard Steamship Company. The Chicago, Milwaukee and St. Paul Railway is affiliated with Osaka Shosen Kaisha. The Grand Trunk Railway System has pooled interests with the White Star Dominion Line and the Atlanta, Birmingham and Atlantic Railway has a compact with the Strachem Shipping Company.

Some Contracts Are not Harmful

For the most part these various commitments are ten-year contracts, with option of renewal. Most of them may be

cancelled upon six months' notice by either party or upon shorter notice by mutual consent. Before the Shipping Board committee went below the surface in its investigation, it was assumed that all the contracts were approximately on a par, insofar as effect upon American merchant marine interests might be concerned. It developed at the hearing, however, that there is a wide disparity in intent and influence. Some of the contracts seemingly offer no practical menace whatever to the American merchant marine. For example, the contracts of the Pennsylvania Railroad and the Northern Central with the International Mercantile Marine Company merely relate to the use of specific piers owned by the roads, a use not discriminatory against other shipping. Then again there is the case of the Grand Trunk contract with the White Star Dominion Line. It was brought out that the only purpose of this compact was to secure for the port of Portland, Me., during the winter months, traffic that is almost wholly of Canadian origin. It was predicted that the only effect of a rigid repressive policy in this quarter, at the behest of the Shipping Board, would be to drive traffic to Canadian ports with no compensatory advantage to either American ports or the American merchant marine.

Pursuing the subject, it might be added that one of the outstanding features of the Washington conference was the warning by railroad executives that the Shipping Board must, in its zeal to preempt the field for the American merchant marine, proceed cautiously lest it drive to Canadian ports transatlantic and transpacific traffic that the United States ports can ill afford to lose. This was the plaint in particular of W. P. Kenney, vice-president and director of traffic of the Great Northern Railway—an executive whose viewpoint was the more interesting because he was formerly the head of the Great Northern Steamship Company. Indeed, Mr. Kenney remarked at one point that the Great Northern has expended to date more money than has the United States Shipping Board to keep the American flag on the Pacific.

Danger of Diverting Cargo to Foreign Ports

Defending his company's contract with the Nippon Yusen Kaisha and its renewal in the face of the Government's concentration on the upbuilding of an American merchant marine, Mr. Kenney stressed the danger that Japanese ships be diverted to Canadian ports and Japanese cargoes be routed via Canadian transcontinental railroads to destinations in the eastern part of the United States. The Great Northern executive, reacting to the patriotic plea, took a fling at the numerous shippers in the United States who are routing their Oriental shipments via the Canadian Pacific to the coast and thence via Canadian ships to the Far East. And he had something to say regarding the Dollar line of steamers which, upon passage of the La Follette Act, sought a Canadian port and alien registry and which, Mr. Kenney declared, now gets more tonnage from the United States than does any American line on the same route.

Throughout the discussion the traffic director of the Great Northern maintained that he had renewed his contract with the Japanese line so recently as October, 1921, simply because he felt that, if there was in the compact anything antagonistic to American public policy, the Shipping Board had ample authority to nullify the agreement. It was difficult, however, for the Shipping Board commissioners to sympathize with this viewpoint. Chairman Thompson said earnestly that he felt that the principle was inescapable that the Great Northern had, by this contract renewal, gone into direct competition with the Government in its effort to establish a merchant marine, at the very moment when the Government thought that it had assurance of the cooperation of all agencies. The commissioners felt especially aggrieved that the Great Northern had not even conferred with the Government before renewing its contract, albeit the Government has on the Pacific a service comparable with the Japanese and is planning to place five fast steamers in the Seattle service, even though it be necessary to operate these at a loss as the ships on this route have been operated at a loss in the recent past.

Cannot Influence Shippers Beyond Their Own Lines

With varying degrees of emphasis the railroad executives who demurred at cancellations of their contracts with foreign shipping interests pivoted their justification on one outstanding radical premise. This theory was that American railroads benefit individually from foreign shipping contracts by allocation of incoming tonnage but, because of a lack of ability to dictate as to the disposition of outbound tonnage, are unable to do any harm to American shipping. It was a bald assumption that the contracts are in distribution of benefits, decidedly one-sided, or that the American railroad has, as one spokesman put it, "the long end of it."

To support such a theory requires, of course, a daring logic. The railroad men had it ready to hand in the contention that, under present conditions, an American railroad —no matter how keen it may be to throw business to an affiliated shipping interest (American or foreign)—is unable to influence shippers as to routes or carriers beyond its own lines, save in rare instances. Control has been taken from the railroads in the routing of this overseas business according to this school of thought. In proof of it, Traffic Director Kenney of the Great Northern Railway pointed out how his road's Japanese shipping ally was first chagrined and then incensed at the inability of the Great Northern to turn over its traffic bound beyond the Pacific and how finally the Nippon Yusen Kaisha, facing the inevitable, had been compelled to build up its own freight soliciting organization in the United States until today the Japanese line has in New York, Chicago and other traffic centers larger organizations than the Great Northern itself maintains.

Relation of Inbound and Outbound Traffic

That theory which assumes that the railroads are able to secure, through the intervention of foreign shipping interests, a worthwhile aggregate of inbound tonnage without repaying in kind was only equalled in interest in the presentation at the conference by the plea that American railroads are capable of maintaining alliances with foreign shipping lines without giving to the latter any special concessions or any treatment preferential in any way to that vouchsafed to all other lines, including, of course, the American flag lines with which there are no such special contractual relations. The leading exponent of this theory at the conference was Mr. Archibald Fries, vice-president in charge of traffic, Baltimore and Ohio Railroad. The Baltimore and Ohio executive insisted that the contracts of his line with British and Scandinavian shipping companies, as above enumerated, do not beget for these connections any service or privileges not given to more than a score of other lines (American and foreign) that dock at the Locust Point piers of the Baltimore and Ohio.

It was explained by the Shipping Board commissioners that the objectionable element in contracts such as have been entered into by the Baltimore and Ohio with foreign lines lies in the grant of free use of piers and in the promise on the part of the railroad company to use its "best endeavors" to promote the business of the affiliated line. This precipitated quite a discussion as to the precise meaning of the term "best endeavors" but the representative of the Baltimore & Ohio insisted that both his principals and the foreign shipping companies and their agents understood that the contracts assumed that there was to be no discrimination for or against any line. In answer to a question as to how, in the face of the "best endeavors" clause, the Baltimore & Ohio

(*Concluded on page 22.*)

Developments in Marine Insurance

Lake Underwriting Experience—Deck Loads—Government Threat—Court Decisions—Builder's Risks—The Tanamo

By "Bordereaux"

NAVIGATION on the Great Lakes has closed for another season, and in the opinion of underwriters it has been a period of unusual experiences. The world-wide slump in shipping has been felt very keenly on the Lakes; October and November, in particular, were two of the very dullest months in freight ever on record in that region. During the entire season the movement in ore, which comprises one of the two largest commodities shipped over the Lakes, was extremely dull, due to slack business in the steel and copper industries. Up to November 1 only 22,087,786 tons of ore had been shipped eastbound over the Lakes, as compared with 50,951,942 tons for a like period of 1920. Ordinarily there is a rush of shipments as the close of the season approaches, but this year the offerings were far below those of previous years. Grain, on the other hand, moved in considerable volume throughout the year and was rushed forward in numerous ship loads as the final day of navigation drew near. Total shipments for the season exceeded 200,000,000 bushels, which is an increase over the movement of this commodity in 1920 by close to forty percent. The reason lies in the low price of grain, creating a large demand from abroad; but a late sharp decline in the foreign demand resulted in a glut of grain at Atlantic ports and the resultant employment as storage warehouses of vessels laid up for the winter. The charge for insurance on values so stored is about two-thirds of a cent per $100 per day—a practice that has been in active vogue for years, the lake marine policy carrying a regular winter storage clause to this effect.

The usual exciting scenes were again enacted at Lake ports as the hour for the close of navigation approached. Twenty steamers were rushed out of Fort William, Ont., in twelve hours, carrying more than $7,000,000 worth of grain. The last vessel to get away and take advantage of the lower insurance rates beat the clock by the narrow margin of only fifteen minutes.

Navigation on the Great Lakes, by the insurance schedule, covers about two hundred and fifty days, the actual period depending upon ice conditions during April and December. In an open season navigation often continues as late as December 20, but as the lighthouses and other aids to navigation are not in operation after the sixteenth of the latter month, vessels find it difficult to procure insurance for sailings from the head of the Lakes after the twelfth. Hull policies permit of navigation up to December 1 at the policy rate, with additional sailings granted up to December 12 at heavily increased quotations subsequent to the first.

On the whole, hull insurance experience on the Lakes has been favorable throughout the season; but cargo premiums have fallen off. Low water during the last few weeks of the season was responsible for numerous strandings, and after the severe storm in early November the water level at the lower end of Lake Erie became so low that many groundings occurred and vessels drawing more than fourteen feet were not allowed to enter the Welland Canal. It is expected that next year will see a return to almost normal activity on the Lakes, as many of the vessels that during the war were brought down to the Atlantic coast have returned in answer to the demand of the grain movement for boats that can pass through the Welland Canal to Montreal and to the sea.

Regulating Deck Loads

SHIPOWNERS and operators will find much to interest them in the model rules proposed in the Hague Rules, 1921, designed to guard against the disastrous consequences of excessive deck loads. Insurers are conscious of the enhanced hazards involved in stowing five percent or more of a cargo above the weather deck, and they are convinced that the carriers know of the added dangers but take chances for the sake of more freight. Several resolutions were devised by the conferees at the Hague, covering the point, and they are urging their several Governments to give them legislative support to the end that there may be a decrease in shipping casualties caused primarily by the overloading of decks. Following are the Hague resolutions:

(1) That all ships which carry deck cargoes exceeding 5 percent of their total deadweight capacity should have a certificate indicating their fitness to carry such deck cargoes.

(2) That a uniform system of issuing certificates of fitness should be adopted by the various maritime States.

(3) That, with a view to arriving, if possible, at a uniform system in the various maritime States, it should be submitted to international expert opinion to decide whether, in addition to the above requirements, a uniform system of fixing a special load line and for absolute regulations restricting height and weight of deck cargoes would be desirable.

(4) That, in any case, the British regulations with regard to light woods can be modified with advantage.

(5) That the Maritime Law Committee take such steps as may be required to induce the Governments of the various maritime countries to arrive at an international understanding on the lines above mentioned.

Government Investigation Threatened

CONSIDERABLE excitement has been created among marine underwriters of late by intimations from Washington that the Government is seriously considering engaging in cargo insurance on account of the alleged discrimination made by underwriters against Shipping Board boats. The Washington authorities insist that shippers making use of Board vessels are charged a substantially heavier rate than is asked for regular liners and that this increases the overhead to an extent that militates seriously against the upbuilding of our merchant marine. This has been specifically denied by the marine insurance men. They point out that insurance is a science and that in the making of rates due consideration is necessary for such elements as past records of steamship lines and the experience of those operating them.

It would be a gross injustice to operators of lines that have shown a favorable record through a long term of years to charge them an added rate in order to offset losses likely to arise at the hands of less capable operators. However, the latest authoritative information from Washington is to the effect that the Shipping Board commissioners have finally abandoned the idea of putting the Government into the business and now propose to limit their activity as regards marine insurance to a thorough investigation. "We propose," says Commissioner Meyer Lissner, "to make a thorough scientific investigation and not to jump to any hasty conclusions."

Doubtless the reason for not carrying out the original

threat has three angles. The Jones Act does not grant authority for the Government to go into the business; no appropriations committee would grant the large sums necessary; and the country is in no temper to support the idea of more Government in business. The Shipping Board has named a commission to study the marine insurance situation, and Commissioner Lissner is at its head. One of its first efforts, so it is stated, will be to obtain the co-operation of underwriters in naming rates equal to those on privately owned tonnage.

The Burning of the "Tanamo"

A NUMBER of interrogations were received by the underwriters after the sinking of the steamer *Tanamo* with its cargo in New York harbor. Those interested in risks of this character were anxious to learn how nearly their insurance policies covered them. It appears that a fire raged in the hold of the ship during a considerable part of the trip from Porto Rico to New York and the only way it could be controlled was to open the seacocks and permit the vessel to fill. The fire damage is, of course, a particular average; the damage done by the sinking will be made good in general average. Even though it is shown that the fire was of incendiary origin, as is suspected, the liability of the underwriters will not be reduced, as fire and its consequences are covered unless the fire be occasioned by an agency specially excluded from the policy; and this is not the case with ordinary incendiarism.

Encouragement From the Courts

TWO court decisions have recently been most favorably received by the marine underwriters. One was the fine of $250 imposed on the *Santa Tecla* by Judge Learned Hand of the United States District Court of New York for violating the regulations with regard to polluting the waters of the harbor by the discharge of waste oil. The offense was committed at Pier 33, South Brooklyn, nearly a year ago, and the circumstances were an attendant permitted a tank to overflow while the vessel was receiving her supply of fuel oil. The campaign against polluting harbor waters by oil discharge has been actively backed by marine insurance interests, and by fire men as well, largely because of the extreme danger to shipping and harbor property occasioned by floating oil. Federal legislation along this line is under consideration at this time by the Rivers and Harbors Committee of the House. It is believed that regulations will be devised for the control of this perilous practice and that in them will be included an arrangement for disposing of oil waste at our chief ports by means of adequate plants that will pay for the oil and carry it off to be burned after the valuable by-products have been extracted.

The second piece of court encouragement came from the Federal District Court at Norfolk, Va., which returned indictments charging the owner and three members of the crew of the *Charles G. Endicott* with conspiracy to scuttle the ship and also with actually casting away a vessel at sea. The *Endicott* was an American schooner. She sank last February off the Cuban coast while carrying a cargo of coal and her ten survivors told an identical tale of collision with a floating mine. She was insured in the New York and London markets for $181,000 on war risk coverage and $176,000 on straight marine. The actual value of the ship was figured at about $100,000, even at a time when values were very high; the remainder fell under the head of charter property insurance. Some of the insurance was paid, but the foreign underwriters instituted inquiries that have finally resulted in the action taken by the Federal court at Norfolk. In this connection it is interesting to recall that a statute still survives that makes the crime of barratry punishable with death; the offense charged against those held responsible for the sinking of the ship, however, is of a statutory nature other than barratry.

Builder's Risks on Equitable Basis

BEFORE the commencement of shipbuilding on such a large scale in the United States all builder's risks, whether of steel or wooden construction, were covered under a form known as the "Institute Clauses for Builder's Risk." The worst feature of this form was a clause which gave the builders permission to increase the value from time to time, and also provided that in the event of a loss the sum insured should be regarded as the insured value. When the American Hull Builder's Risk Committee took up the task of drawing up a new builder's risk form, one which would be equitable to both assured and assurer, they immediately changed this clause. The value of the vessel insured was to be at all times the completed contract price of the vessel, and the whole amount was to be insured from the date of laying of the keel.

The reason for this clause is: Where insurance is placed in installments the average liability under a policy is increased. The larger number of installments the more nearly the average liability approaches the full amount of the policy, making the real the same as the apparent rate; the real rate being the actual rate on the liability assumed, and the apparent rate being the rate at which the policy is written. Therefore one result of insuring on the installment plan, and indeed the underlying reason why assured and brokers always favor the installment plan, is to reduce the rate which had already been agreed upon as the proper one.

Valuing the property—that is, the vessel insured—at the amount of valid insurance in force at any given time is extremely objectionable, because a company never would know just what proportion of any loss it would be called upon to pay, or its ratio of liability.

Rating Shipping Board Vessels

MARINE insurers are wondering how the Shipping Board commissioners can reconcile the clamor for lower rates on their boats with the announcement of Chairman Lasker that of fourteen hundred steel vessels owned by the Board one-third are useless for ordinary commerce and another one-third are but moderately suitable. Coming on top of Commissioner Lissner's declaration that Shipping Board vessels are just as good as any other vessels and entitled to as low an insurance rate as the best, this would indicate a considerable divergency of opinion. It is reported that the A. G. W. I. Lines have turned back their lake-built boats to the Shipping Board on the ground that they could not be operated profitably. These boats were constructed for coastwise trade and, if steamship lines engaged in coastwise service can not operate such vessels profitably, they might, it would appear, as well be scrapped now as to be maintained in idleness for several years before the scrapping takes place. Underwriters are wondering whether Commissioner Lissner is of opinion that they should be operated transatlantic at approved liner insurance rates.

Gothenburg Dry Dock Built in Germany

In a description of the new dry dock at Gothenburg, published on page 445 of our June, 1921, issue, it was stated that this dry dock was built by the owners, the Eriksbergs Mek. Verkstads Aktiebolag, Gothenburg. Since the publication of this article we have been informed that the dock was built for the above company by the Brückenbau Flender Aktiengesellschaft, Benrath and Lübeck, Germany, from designs by Mr. von Klitzing of Hamburg.

U. S. S. Tampa, the First of the New Electrically Driven Coast Guard Cutters

Electric Drive Applied to Coast Guard Cutters

Cutter Tampa Driven by First Synchronous Motor Built for Marine Propulsion—Practical Advantages of Synchronous Motor

By Captain Q. B. Newman, U. S. C. G.*

IN discussing types of propelling machinery for ships, the points usually considered in the order of relative importance are reliability, efficiency, durability, weight, space occupied and cost to construct and install. For many years the machine which answered the requirements more fully than any other was the faithful old reciprocating steam engine with its multiple expansions.

The Revenue Cutter Service, forbear of the present Coast Guard, had an honorable part in its development and took a pardonable pride in its achievements. There is scarcely an American text book on marine engineering which fails to include somewhere the classic experiments on the *Rush, Gallatin, Dexter* and *Dallas* to determine the effects of steam jackets, the benefits of compounding and the merits of small bore and long stroke as compared to large bore and short stroke.

One day a ruthless scientific person pointed out that the multiple expansion engine is not sufficiently expansive and that, inasmuch as half of the original energy of the steam is still in it at atmospheric pressure, we should travel down the vacuum line till it begins to touch bottom, if we would have real efficiency. Someone else suggested that superheated steam would catch a lot of heat that formerly went up the stack, and the days of the reciprocating marine engine began to close. For, although the low pressure cylinder had been divided into two, it was still too restricted and superheat was bad for cylinder lubrication and for high pressure rods.

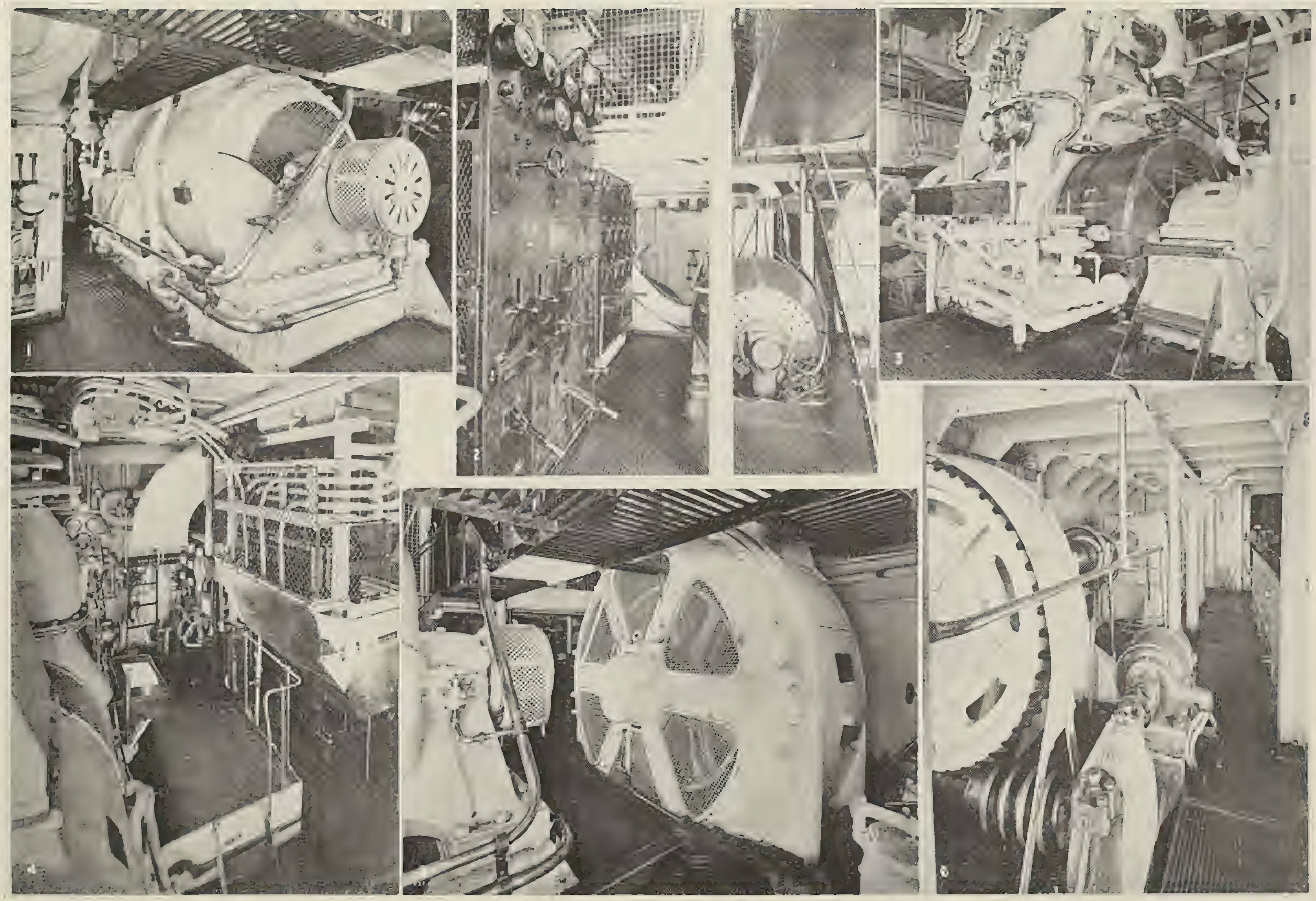
At the head of the list of Coast Guard requirements is responsiveness. You can back up on a lee shore till there is only a foot of water under the keel, if you are absolutely sure there is instantaneous power at the other end of the telegraph, but you cannot do it with confidence if you must wait half a minute or a minute while a turbine gathers way. And so the Coast Guard was forced to adhere to the reciprocating engine for a long time after it began to lose caste elsewhere, because it was the only machine which had this quality of responsiveness.

The *Jupiter* demonstrated beyond doubt the availability of electric machinery for marine propulsion, combining the high efficiency of the steam turbine with all the maneuvering promptness of the reciprocating engine. Later came the *New Mexico,* which confirmed previous experience and removed electric propulsion from the realm of conjecture. Both of these ships, however, used the induction motor, whose low power factor (about 78 percent) necessitates increased sizes of copper conductors and therefore of machinery throughout.

Propelling Machinery of New Cutters

The development of a propelling outfit suitable for small ships of relatively low power was taken up in the summer of 1919, when, in a series of conferences between engineers of the Coast Guard and the General Electric Company, the

*Engineer-in-Chief, United States Coast Guard.



Coast Guard Cutter Tampa: (1) Port Side of Turbo-Generator (looking forward); (2) No. 2 Exciter and Distribution Board; (3) Starboard Side of Turbo-Generator (looking aft); (4) Turbo-Generator, Operating Panel and Control Group; (5) 2,600 Shaft Horsepower Synchronous Motor; (6) Shaft Alley and Engineers' Storeroom

United States Coast Guard Cutter Tampa

General Information

Service: General police and survey work in territorial waters.

Builder: Union Construction Company, Oakland, Cal.

Owner: United States Government, Treasury Department.

Characteristics

Length, overall	240'-0"
Length, B. P.	220'-0"
Breadth, molded	39'-0"
Depth, molded	25'-6"
Draft, loaded, mean	14'-3"
Draft, light, mean	11'-7"
Block coefficient	0.471
Midship section coefficient	0.89
Area of midship section, square feet	482
Tons per inch immersion at L.W.L.	13.26
Area of wetted surface, square feet	9,496
Longitudinal coefficient	0.5328
Speed, loaded, knots	16
Cruising radius, nautical miles	
Framing	Transverse
Class	

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	
**Weight of Propelling Machinery	
Deadweight Capacity	
Displacement, Loaded	1,650

(In tons of 100 cubic feet)

Gross register	1,330.77
Net Register	320.00

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama	1,499.27	202.8

Equipment

2 Bower stockless anchors, each	4,000 lbs.
1 Bower stockless anchor	2,500 lbs.
1 Stream anchor, ex-stock	750 lbs.
1 Kedge anchor, ex-stock	400 lbs.
2 chain cables, 1¾" stud link, each	120 fms.

Rudder

Area, square feet	75.8
Dia. Stock, inches	9
C. Press, abaft C. L. pintles, inches	90.9

Complement

Deck Officers	4
Engineer Officers	3
Medical Officer	1
Deck crew	49
Engineer crew	17
Commissary department	6
Messmen	9
Total officers and crew	89

Handling Equipment

	No.	Type	Capacity	Length
Masts	1	Pole	....	....
Booms	1	....	10,000 lbs.	....

Discharging Capacity

Deck Machinery

Steering gear, Hydro-electric, Telemotor control

Windlass, steam, vert., 2 cylinder 8x8

Capstan, electric driven, rope speed 70 feet per minute

Life Saving Equipment

Lifeboats	No.	Capacity	Length
Monomy surf	2	......	26
Motor dinghy	1	......	22
Sailing launch	1	......	26
Motor sailing launch	1	......	26
Dinghy	1	......	18
Surfboat (self-bailing)	1	......	26
Whaleboat	1	......	27

Propelling Machinery

Boilers

Number	2
Type, Babcock & Wilcox watertube	
Length of tubes between headers, 9'-0"	
Diameter of drum, inches	42
Burners in each boiler, 4 Peabody	
Fuel	oil
Draft	forced
Total heating surface, including 600 sq. ft. of superheaters, square feet	6,400
Total furnace volume, cubic feet	600
Supheat, degrees F	50-75
Working pressure, lbs. per sq. in	200
Smoke pipe, inside diameter	5'-3"
Smoke pipe, height above burners	70'-0"
Normal fuel consumption:	
Per day, tons	
Per horsepower hour, pounds	
Normal steam production:	
Per hour per pound of fuel	lbs.
Total per hour	lbs.

Engines

Main Turbine, Gen. Elect. Curtis Type.

Number of stages	8
Number of nozzles	24
Steam pressure, lbs. per sq. in	200
Superheat, degrees	75
Vacuum, inches	28
Revolutions per minute	3,000

Main Generator, alternating current type.

Number of poles	2
Number of phases	3
Revolutions per minute	3,000
Kilowatts output	2,040
Volts	2,300

Main Motor, synchronous type.

Number of poles	46
Volts	2,300
Number of cycles	50
Revolutions per minute	130
Shaft horsepower	2,600

Propellers

Number	1
Type	4 bladed, solid cast steel
Weight	
Diameter	13'-0"
Pitch	14'-0"
R. P. M.	130
Projected area, square feet	52.43
Developed area, square feet	63.11

Auxiliary Machinery

Machinery Space

Condenser, (1) main, 3,600 sq. ft. cooling surface

Condenser, (1) auxiliary, 600 sq. ft. cooling surface

Evaporator, (1) capacity 6,000 gals. per 24 hrs.

Distiller, (1) capacity 1,000 gals. per 24 hrs.

Filters

Feed water heater, 35,000 gals. per hr. 90° F. to 200° F.

Fuel oil heaters, (2) 3,000 lbs. per hr., 16° Beaume heated from 60° F. to 200° F...

Pumps

(2) Feed vert. simp., dbl. act'g 10 x 6 x 24

(1) Main circulating, 14" centrifugal, turbo-drive

(1) Main fire, 6" centrifugal, turbo-drive

(1) Main air, vert., single act'g., twinplex beam ..... 12 x 22 x 18

(2) Fuel oil, vert. dup., dbl. act'g ..... 5¼ x 3½ x 5

(1) Comb. air & circ., horiz. simp., dbl. act'g 7½x10x10x10

(1) Bilge, vert. simp., dbl. act'g. 6½ x 8 x 8

(1) Sanitary, horiz. simp., dbl. act'g. ..... 8 x 8 x 12

(2) Lubricating oil, vert. simp., dbl. act'g ..... 6½ x 7 x 8

(1) Lub. oil cooler, vert. simp., dbl. act'g ..... 7 x 8 x 10

(1) Evap. feed, vert. simp., dbl. act'g ..... 3½ x 4 x 4

(1) Fresh water, vert. simp., dbl. act'g ..... 3½ x 4 x 4

(1) Injector

(1) 3" Bilge ejector

(1) Forced draft blower, turbo-driven, capacity 18,000 cu. ft. per min. at 2½" pressure

(1) Ventilating set, electrically-driven, capacity 18,000 cu. ft. per minute

(1) Turning gear—5 H. P. electric motor and worm gearing to main shaft

Refrigerating Machinery

One-ton unit of Audiffren-Singrun type, driven by a 5 horsepower, direct current motor

Electric Equipment

Generators, (2) 225-110 volt, 100 K. W. sets turbo-driven

Radio

Emergency

Refrigerated Space

Compartment	Cu. Ft.
Food	576

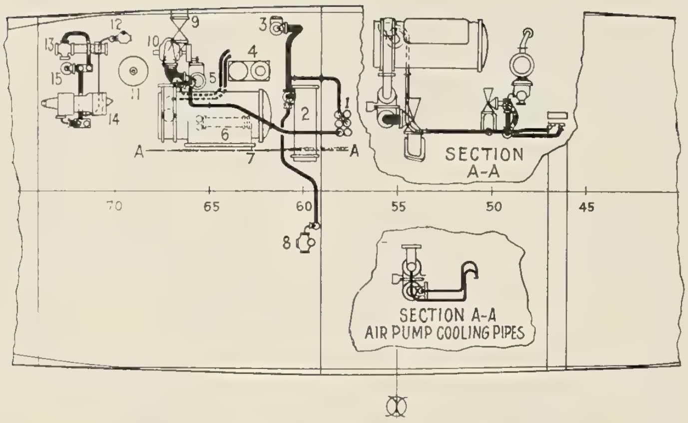
Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons.
Deep Tank-Frs. 36-46 S.	3,720	661	99.2
Deep Tank-Frs. 36-46 C.L.	4,275	759	114.0
Deep Tank-Frs. 36-46 P.	3,720	661	99.2
Total	11,715	2,081	312.4

*37.46 cu. ft. per ton; 42 gals. per bbl.

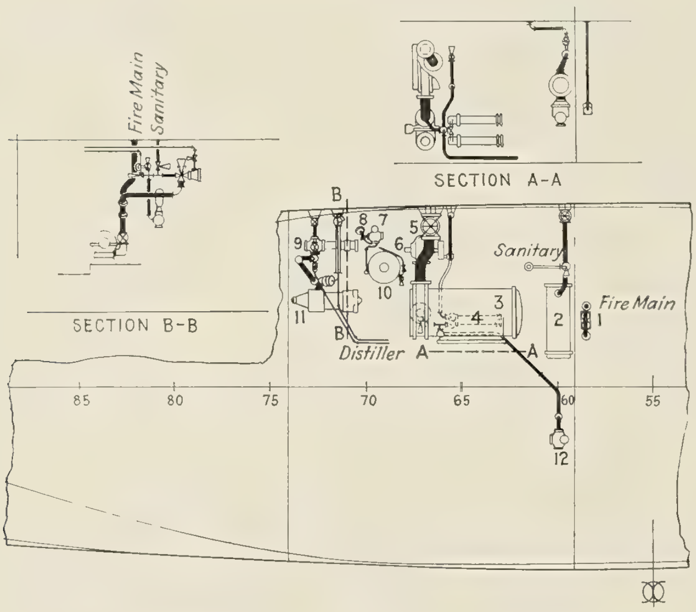
Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Fore Peak			23.3
Dbl. Bot.-Frs. 47-59 S.	368	10.25	
Dbl. Bot.-Frs. 47-59 C.L.	821	22.85	
Dbl. Bot.-Frs. 47-59 P.	368	10.25	
Dbl. Bot.-Frs. 59-68 S.	537	14.93	
Dbl. Bot.-Frs. 59-68 P.	537	14.93	
Dbl. Bot.-Frs. 68-74 C.L.	462	12.87	
After Peak	357	9.95	
Total	3,450	96.03	23.3



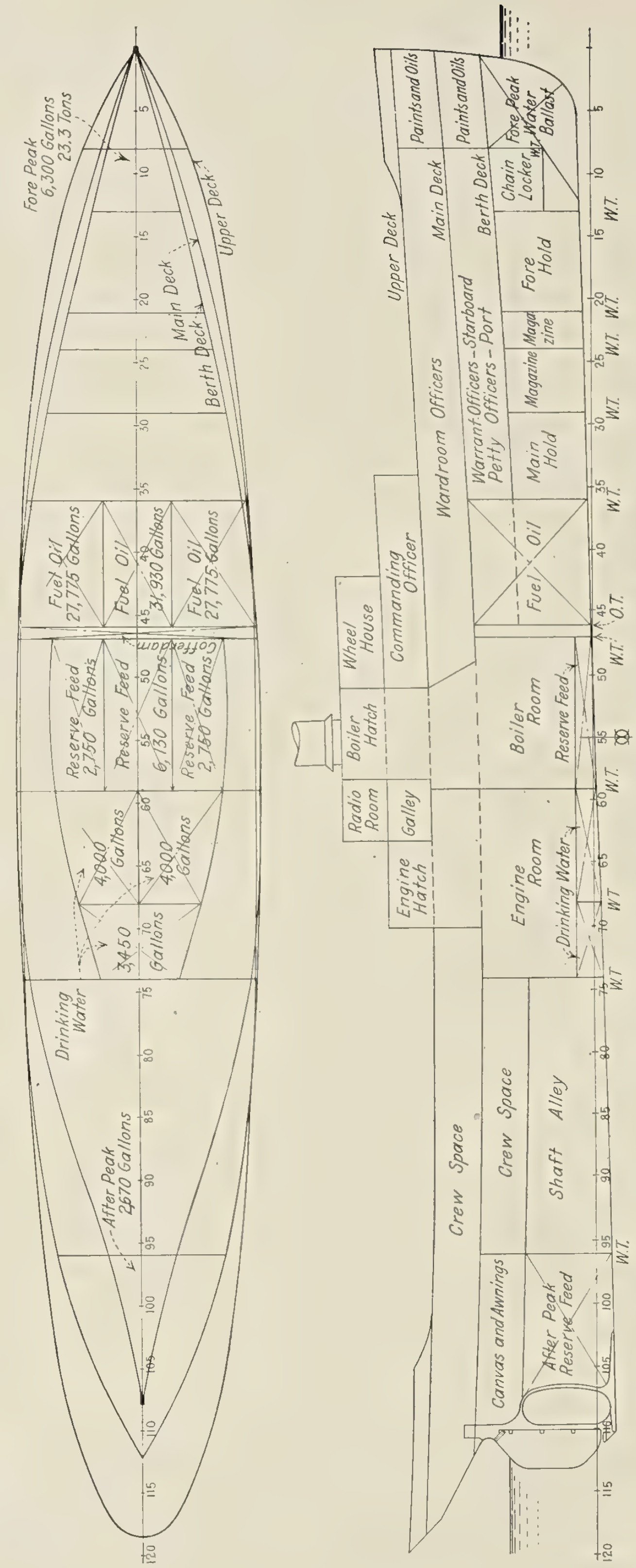
No.	Description	No.	Description
1	Aux. feed pump suction manifold.	8	Lubricating oil cooler pump.
2	Aux. condenser.	9	Main overboard discharge.
3	8-in. sea suction.	10	Main circulating pump.
4	Main air pump.	11	Evaporator.
5	14-in. sea suction.	12	Evaporator feed pump.
6	Lubricating oil cooler.	13	Sanitary pump.
7	Main condenser.	14	Fire pump.
		15	8-in. sea suction.

U. S. Coast Guard Cutter Tampa—Salt Water Suction Piping



No.	Description	No.	Description
1	Aux. feed pump discharge manifold.	7	Evaporator feed pump.
2	Aux. condenser.	8	Evaporator sea blow down.
3	Main condenser.	9	Sanitary pump.
4	Lubricating oil cooler.	10	Evaporator.
5	Main overboard discharge.	11	Main fire pump.
6	Main circulating pump.	12	Lubricating oil cooler pump.

U. S. Coast Guard Cutter Tampa—Salt Water Discharge Piping



U. S. Coast Guard Cutter Tampa—Watertight Subdivision

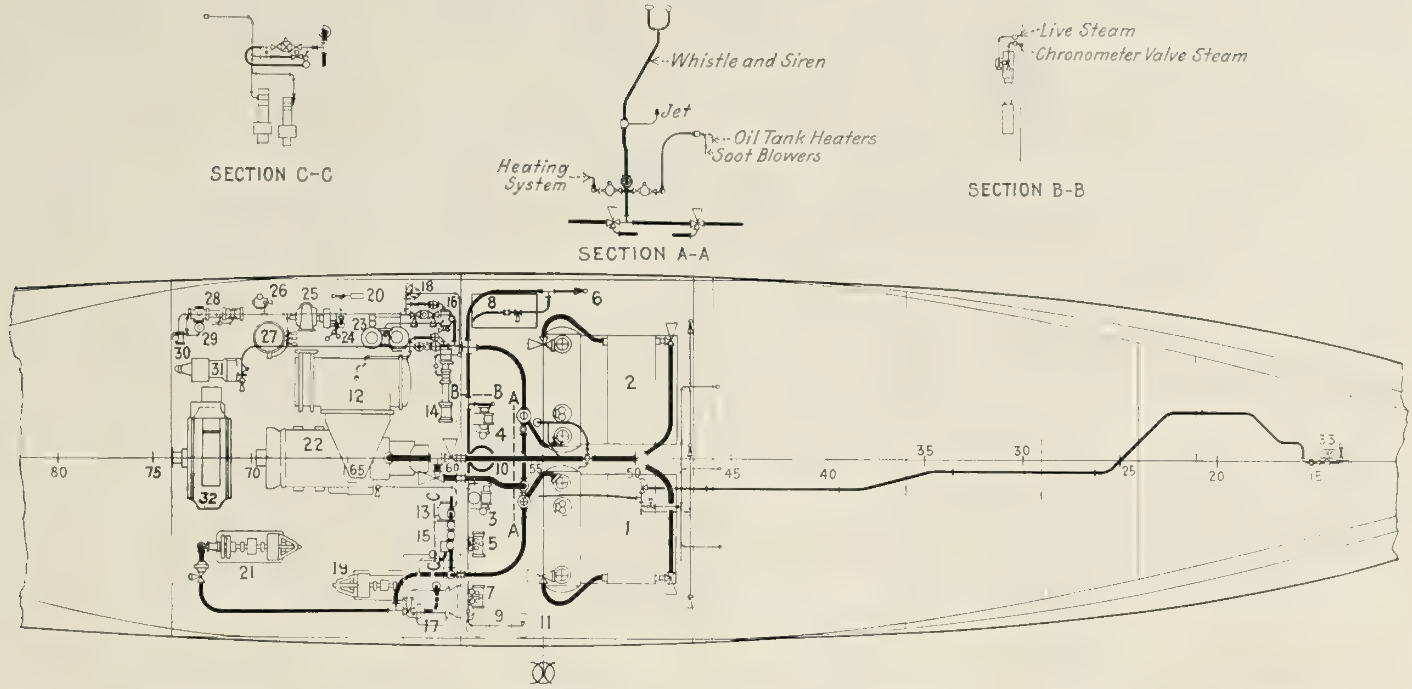
plant described below was worked out and later installed in the Coast Guard Cutters *Tampa, Haida, Mojave* and *Modoc.*

The main turbo-generator is very similar in all essential characteristics to the machine which the General Electric Company has been building for a number of years for shore stations. The turbine has eight stages, runs at 3,000 revolutions per minute and delivers its power to the generator through a flange coupling. Steam conditions are 200 pounds pressure (gage), 75 degrees superheat and 2 inches back pressure.

Speed regulation is controlled by an oil governor. The speed lever on the operating panel opens a leak-off in the oil system, thereby lowering the pressure. The throttle valve gear is operated by a governor spring working against the oil pressure, so that lowering the oil pressure by means of the leak-off allows the spring to open the pilot valve on the main hydraulic cylinder which increases the opening of the throttle valve.

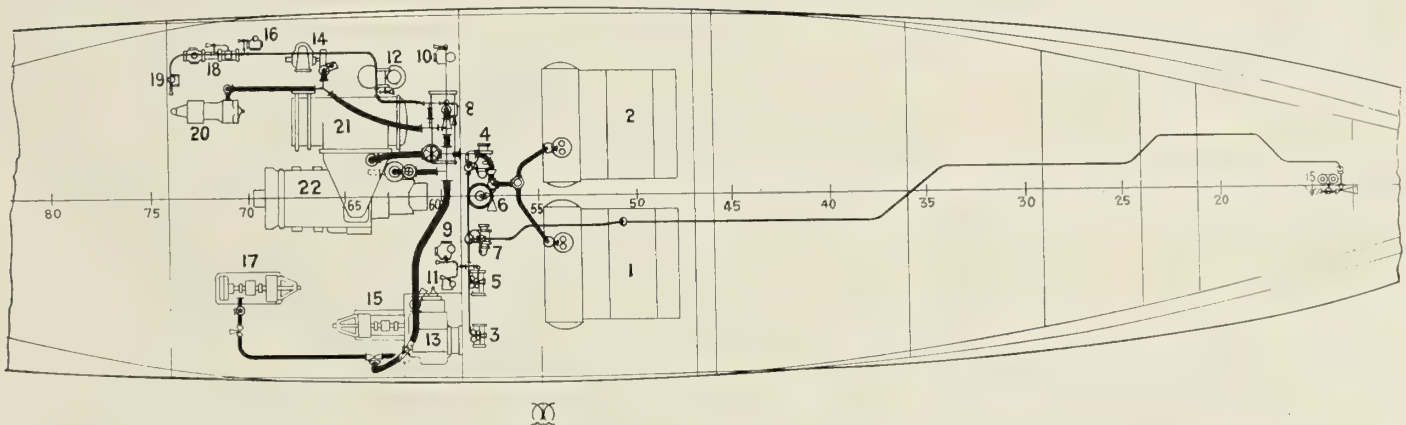
Auxiliary exhaust steam at 7 pounds (gage) pressure is admitted to the fifth stage of the main turbine. This accomplishes three purposes, all of major importance. It fixes proper conditions for heating the feed water, it utilizes the main turbine to wring all the heat from the auxiliary exhaust and it protects the vacuum against air leaks in the auxiliary exhaust piping.

The main generator is a two-pole, three-phase, 50-cycle machine, generating 2,040 kilowatts at 2,300 volts. One



No.	Description	No.	Description	No.	Description	No.	Description
1	Main boiler	9	Fuel oil heater.	17	Turbo fan.	25	Main circulating pump.
2	Main boiler.	10	Feed water heater.	18	8-inch forward sea chest.	26	Evaporator feed pump.
3	Main feed pump.	11	Fuel oil heater.	19	Forward exciter.	27	Evaporator.
4	Aux. feed pump.	12	Main condenser.	20	Bilge ejector.	28	Sanitary pump.
5	Fuel oil pump.	13	Lubricating oil cooler pump.	21	After exciter.	29	8-inch aft sea chest.
6	Injector.	14	Aux. air and circulating pump.	22	Main turbine generator.	30	Fresh water pump.
7	Fuel oil pump.	15	Lubricating oil emergency pump.	23	Main air pump.	31	Fire pump.
8	Feed and filter tank.	16	Bilge pump.	24	14-inch sea chest.	32	Main propelling motor.
						33	Anchor engine.

U. S. Coast Guard Cutter Tampa—Steam Piping



No.	Description	No.	Description	No.	Description	No.	Description
1	Main boiler.	7	Main feed pump.	13	Turbo fan.	19	Fresh water pump.
2	Main boiler.	8	Aux. air and circulating pump.	14	Main circulating pump.	20	Fire pump.
3	Fuel oil pump.	9	Lubricating oil cooler pump.	15	Exciter.	21	Main condenser.
4	Aux. feed pump.	10	Bilge pump.	16	Evaporator feed pump.	22	Main turbine generator.
5	Fuel oil pump.	11	Lubricating oil emergency pump.	17	Exciter.	23	Aux. condenser.
6	Feed water heater.	12	Main air pump.	18	Sanitary pump.		

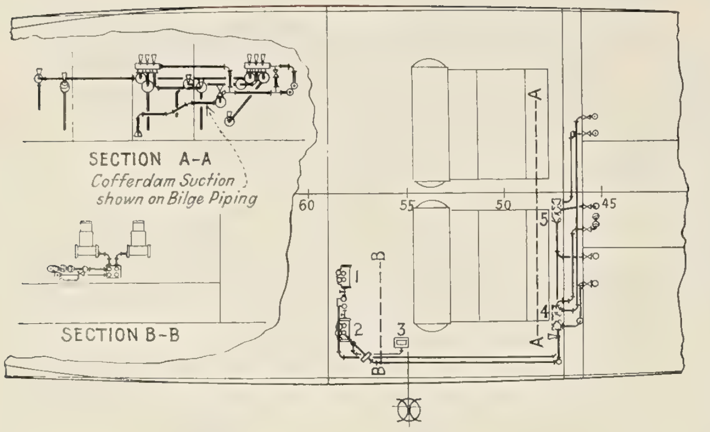
U. S. Coast Guard Cutter Tampa—Exhaust Piping

forging is used for the revolving field, shaft and journal. Slots for the windings are milled in the body of the rotor. The field windings are of flat copper strips adequately blocked against motion in any direction and protected by heavy metal wedges and rings.

The propelling motor, however, is the novel part of the installation, for up to the time these ships were designed the synchronous motor had never been proposed for marine propulsion and the motor in the *Tampa* is the first one built for that purpose. Delays of one sort and another, in no way related to the engineering problems, robbed the *Tampa* of the distinction of being the first ship propelled by a synchronous motor, the S. S. *Cuba* having carried off that honor.

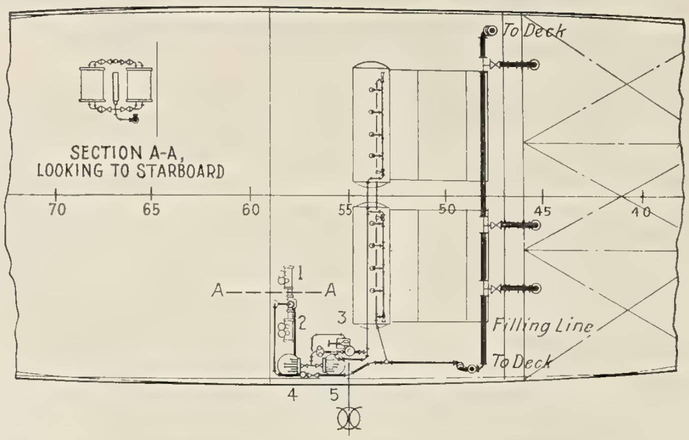
Synchronous vs. Induction Motor

The synchronous motor has a number of features which recommend it, rather than the induction motor, for a propelling machine, chief of which is electrical. Alternating current machinery in general has the characteristic that the current lags behind the voltage whenever the circuit is inductive, that is, the induction resists the rise and fall of current and chokes it back behind the voltage. The lag is expressed as an angle in magnetic degrees, just as a geometrical angle is expressed in degrees of arc. The cosine of the angle of lag is called the "power factor." For example, if the current in a circuit lags 37 degrees behind the voltage, the power factor would be the cosine of 37 degrees, or about



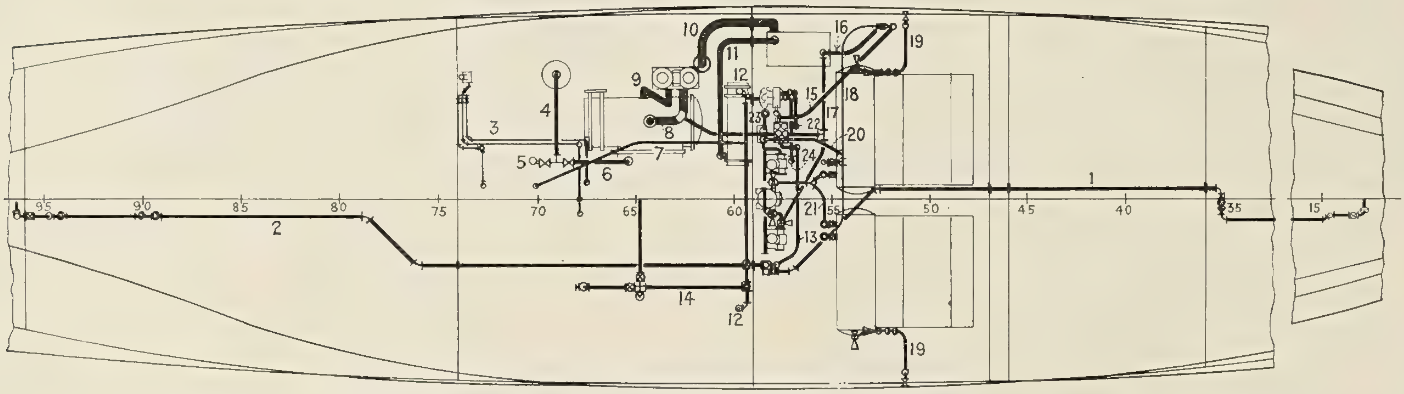
No.	Description	No.	Description
1	Fuel oil pump.	4	High suction manifold.
2	Fuel oil pump.	5	Low suction manifold.
3	Hand fuel oil pump.		

U. S. Coast Guard Cutter Tampa—Fuel Oil Suction Lines



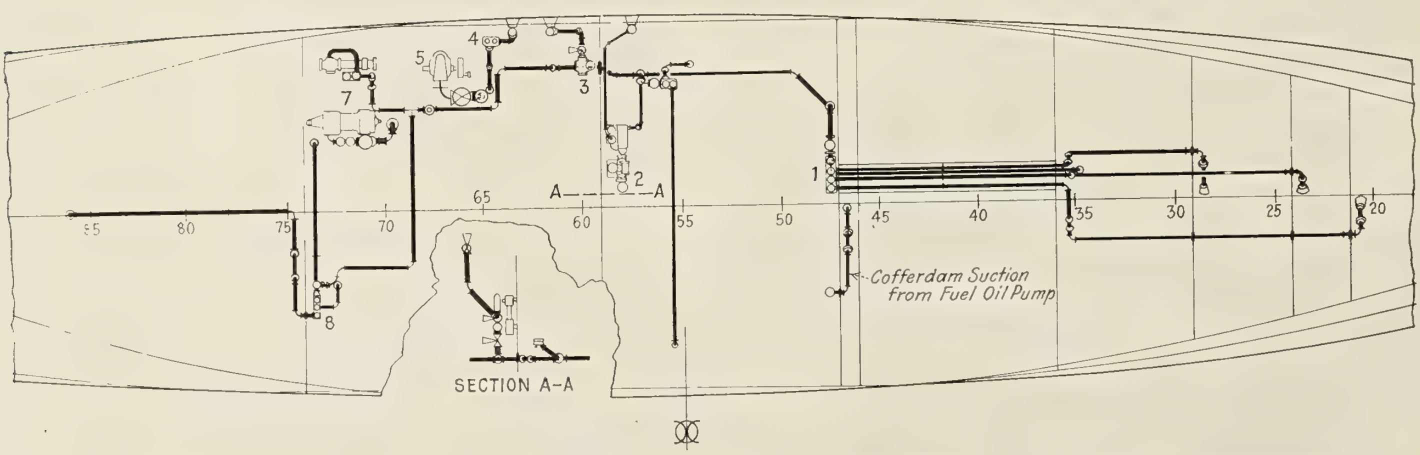
No.	Description	No.	Description
1	Fuel oil pump.	4	Fuel oil heater.
2	Fuel oil pump.	5	Fuel oil heater.
3	Hand fuel oil pump.		

U. S. Coast Guard Cutter Tampa—Fuel Oil Discharge and Filling Lines



No.	Description	No.	Description	No.	Description	No.	Description
1	Fore peak suction and filling.	8	Main air pump wet suction.	15	Injector suction from F.W. tanks.	21	Main feed pump discharge to feed lines.
2	After peak suction and filling.	9	Main air pump dry suction.	16	Injector suction from filter tank.	22	Suction and filling line to port F.W. tank.
3	Pump suctions from drinking tanks.	10	Main air pump discharge to filter tank.	17	Pump suction from filter tank.	23	Suction and filling line to center F.W. tank.
4	Evaporator vapor.	11	Aux. air pump discharge to filter tank.	18	Injector discharge to aux. feed lines.	24	Suction and filling line to starboard F. W. tank.
5	To distiller.	12	Filling pipes from deck.	19	Surface and bottom blow lines		
6	To auxiliary exhaust.	13	Suction and filling line to peak manifold.	20	Aux. feed pump discharge to feed lines.		
7	Distiller discharge to F.W. tanks.	14	Filling line to drinking tanks.				

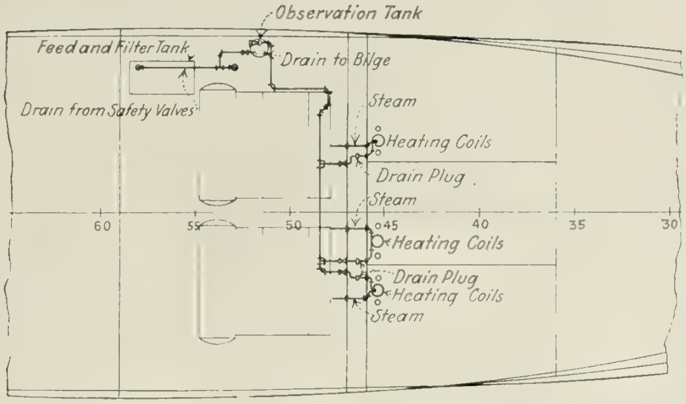
U. S. Coast Guard Cutter Tampa—Fresh Water Piping



No.	Description	No.	Description	No.	Description	No.	Description
1	Fireroom manifold.	3	Bilge pump.	5	Main circulating pump.	7	Fire pump.
2	Aux. feed pump.	4	Bilge ejector.	6	Sanitary pump.	8	Engineroom manifold.

U. S. Coast Guard Cutter Tampa—Bilge Piping

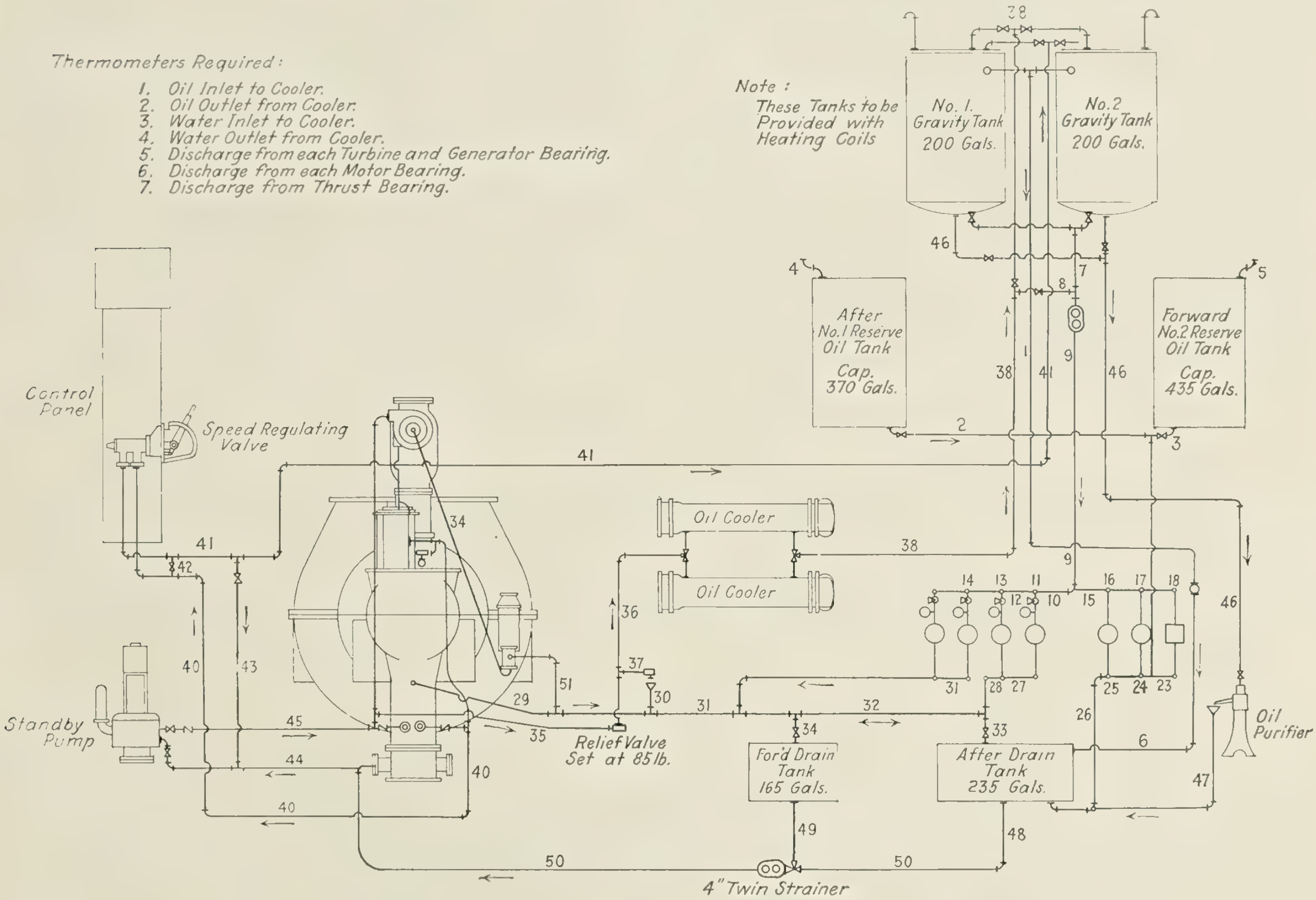
24182



U. S. Coast Guard Cutter Tampa—Fuel Oil Tank Heating Lines

0.80. The effect of power factor is that, instead of taking the product of volts and amperes to get power, that product must be multiplied by the power factor.

In the example cited above the actual power would be only 80 percent of the product of volts and amperes. Heat losses in the main circuit of generator, motor, controls and cables vary with the square of the current, so it is extremely important to keep the current as small as possible, which for any given power requires that the power factor be high. Citing again the 80 percent factor and comparing it with a 100 percent power factor the sizes of all conductors in the main circuit would be in the ratio of about 1½ to 1 with a corresponding difference in size and weight of the whole machine. And, be it noted, 80 percent is a high power factor for an induction motor suitable for ship propulsion, whereas



Line	Size, in.	Service
1	3	Overflow from gravity tanks.
2	3	Makeup from No. 1 reserve oil tank.
3	3	Makeup from No. 2 reserve oil tank.
4	3	Starboard filling line.
5	3	Port filling line.
6	3	Makeup and overflow to after drain tank.
7	2½	Bearing supply from gravity tanks to strainers.
8	2	Cross connection from cooler discharge.
9	2½	Supply line.
10	2	Supply to generator and turbine bearings.
11	¾	Supply to after generator bearing.
12	1½	Supply to generator and turbine bearings.
13	¾	Supply to middle bearing.
14	1¼	Supply to turbine thrust and forward bearings.
15	1¼	Supply to motor and thrust bearings.
16	½	Supply to forward motor bearing.
17	½	Supply to after motor bearing.
18	1	Supply to thrust bearing.
19	1	Drain from after end of thrust, not shown.
20	1	Drain from center of thrust, not shown.
21	1	Drain from forward end of thrust, not shown.
22	2	Overflow from thrust not shown.
23	2	Drain from thrust.
24	1¼	Drain from after motor bearing.
25	1¼	Drain from forward motor bearing.
26	3	Drain from motor and thrust.
27	2	Drain from after generator bearing.
28	2	Drain from middle generator bearing.
29	1½	Overflow from gear pump casing.
30	2	Relief valve discharge from cooler line.
31	3	Forward drain header.
32	3	After drain header.
33	3	Drain to after tank.
34	3	Drain to forward tank.
35	1½	Pump discharge to coolers.
36	2	Discharge to coolers.
37	2	Relief line from discharge to coolers.
38	2	Discharge from coolers to gravity tanks.
39	2	Connection from hydraulic cylinder to aux. steam adms. valve.
40	1½	Connection from variable speed gov. to speed reg. valve.
41	1½	Speed regulating valve discharge to gravity tanks.
42	¼	Speed regulating valve by-pass.
43	1½	Pump suc. from speed regulating valve discharge.
44	1½	Stand by pump suction from drain tanks.
45	1½	Stand by pump discharge to hydraulic cylinder.
46	1	Drain from gravity tanks to purifier.
47	¾	Purifier discharge to line 26.
48	4	Pump suction from after drain tank,
49	4	Pump suction from forward drain tank.
50	4	Pump suction.
51	½	Drain from aux. steam admission valve.

U. S. Coast Guard Cutter Tampa—Lubricating Oil System

the power factor of a synchronous motor is 100 percent. The difference in weight and size is sufficient, in the case of these Coast Guard ships, to determine the possibility of electric drive, i. e., the synchronous motor could be used but the induction motor could not.

The next most important difference between the two types of motors is a mechanical difference with an electrical reason. In order to get as high a power factor as possible, the induction motor must have the smallest possible air gap between stationary and rotating parts, with the result that only limited wear can take place in the bearings before there would be trouble. The air gap of the synchronous motor is usually about 3/8 inch making such trouble extremely improbable. In addition there is a very real advantage in the accessibility of a synchronous motor for repairs. The direct current poles are radial pieces bolted on the outside of the rim of the rotor wheel. They are readily detachable and by removing a few of them any part of the stator windings can be removed or repaired without having to lift heavy weights.

Alleged objections to the synchronous motor, on the part of people who ought to know better, have been urged so persistently as to create honest doubts of its merits. A synchronous motor is alleged to have poor starting qualities when as a matter of fact it has none at all. Neither has a disengaged clutch. But nobody leaves a clutch disengaged, if he wants it to work; neither does he try to get starting torque in a pure synchronous motor. He puts on a simple, cheap and effective squirrel cage winding which brings the motor up to speed and then goes out of business. Such motors have been used successfully for years in rolling mills, probably the most rigorous conditions to be found anywhere, reversing under terrific load every few seconds year in and year out; yet the question is raised whether it will reverse a ship's propeller. Anyhow the question is answered; the *Tampa* has been brought dead in the water from 15 knots in her own length, which should be rapid enough to satisfy the most exacting.

The theory that the motor would fall out of step in a sea way has also been disproved.

The question of whether the addition of a direct current field constitutes an objectionable complication may be a matter of opinion. The theory of this field is simple and readily understood and, if there are more switches, etc., required, they are all mechanically rugged and easily kept in order. The complication is no greater than in an induction motor with external secondary resistances and not so great as in an induction motor with apparatus for improving the power factor.

The motors used in the Coast Guard have 46 poles, giving a speed reduction of 23 to 1. The power developed is 2600 shaft horsepower at 130 revolutions per minute.

Duplicate exciters are installed. Each is a turbine-driven, three wire, 240 volt generator, furnishing sufficient current for excitation and for all lighting and power purposes.

Engineers Extol Westinghouse

"The Life of George Westinghouse," by Col. Henry G. Prout, will soon be published by the American Society of Mechanical Engineers for the following committee: Charles A. Perry, chairman, Paul D. Cravath, Alexander C. Humphreys, James H. McGraw, H. G. Prout, Charles F. Scott, L. B. Stillwell, Ambrose Swasey, H. H. Westinghouse.

"To the memory of few other men, if any, do the engineers of America owe so great a debt of gratitude as to that of George Westinghouse, whose inventions and achievements have not only benefited mankind, but have made possible the enterprises in which so many of our number are now engaged," said Calvin W. Rice, secretary of the society, in a statement explaining that "the underlying motive for publishing a biographic series of great American engineers is to inspire others."

Railroad Contracts With Foreign Shipping Lines

(*Concluded from page* 12.)

would route business that was to be transferred to ocean-going ships, the vice-president declared that his road does not route business at all but merely advertises sailings and allows shippers to choose. And, he stated furthermore, that if there is a congestion of vessels at the docks, all are required to take their turn, regardless of whether of a contract line or not.

Berthing Facilities Denied American Vessels

Despite these assurances the Shipping Board commissioners were plainly dubious regarding the effect of contracts with foreign lines. The chairman said that he knew of actual cases where berthing facilities had been denied to American vessels because of the existence of such agreements. It availed nothing that a railroad company had a fine moral feeling for American shipping, if it was confronted with the physical inability to accommodate American ships because of foreign contracts. With a record of two and one-half million tons of cargo interchanged last year between the ten American railroads represented at the hearing and ships operating under the flags of nations other than the United States it was imperative that steps be taken to give effect to Section 28 of the Merchant Marine Act which clearly defines the intent of Congress that American railroads be preferential feeders of tonnage for American ships.

As an earnest of the harmlessness of existing contracts, the vice-president of the Baltimore & Ohio said that the agents of the Donaldson Lines and Furness Withy and Company had already recommended to their principals that their contracts be cancelled, such was their realization that under present conditions in the United States, such contracts could give to a foreign shipping interest no service or co-operation not available to all rivals. But for all that the Baltimore & Ohio contracts were, in his estimation, virtually inoperative, the vice-president hesitated, on his own initiative, arbitrarily to cancel contracts entered into in good faith with responsible people unless the contractors were willing. Other railroad executives who were present were much more ready to meet the wishes of the Shipping Board without debate or delay. For example, Vice-President L. Green, in charge of traffic of the Southern Railway and Mobile and Ohio Railroad, stated that from what he had heard at the conference he sensed the sentiment of the Shipping Board and that, unless the Board requested him not to do so, he would forthwith take steps to cancel the contracts held by his roads. The attitude of several of the railroad executives is that the contracts that the Shipping Board is objecting to have served their purpose and might as well be scrapped. Owing to the change of conditions, they hold that such contracts can no longer be preferential. Each road and each shipping company is now compelled to work for business wherever it can get it.

Senator France of Maryland has introduced in the Senate a bill, S. 2620, to provide a fundamental change in the method of determining wage scales for employees of government navy yards and arsenals. The bill provides for the creation of a board of adjustment which shall have final jurisdiction and authority to decide upon all questions relating to changes in wage scales and controversies or grievances concerning conditions of labor. The board would be composed of three members.

(Photograph copyright, 1921, by Edwin Levick, N. Y.)

Edgar Palmer's Three Masted Auxiliary Schooner Yacht Guinevere

Auxiliary Schooner Yacht Guinevere

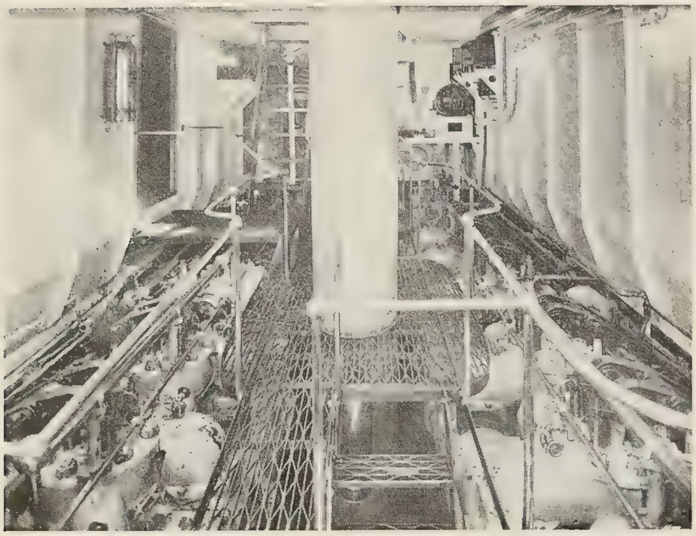
The Largest Fore-and-Aft Auxiliary Schooner Yacht Ever Built Equipped with Diesel Electric Drive

THE successful 14,000-mile cruise of the auxiliary schooner *Elfay,* which had the first Winton Diesel-electric drive ever installed in a vessel, influenced Edgar Palmer of New York to include a similar type of propelling unit in his new yacht *Guinevere* designed by A. Loring Swasey and Arthur Raymond of Boston. This yacht has the distinction of being not only the largest Diesel yacht built in this country but also the largest fore-and-aft auxiliary schooner yacht in the world.

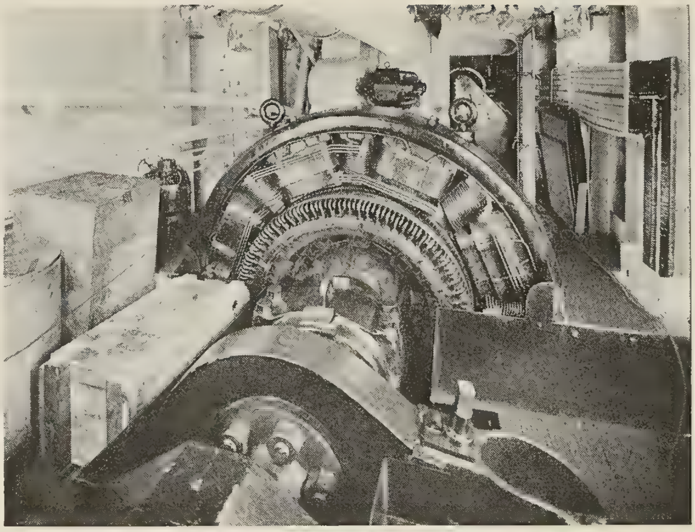
The *Guinevere* has an overall length of 195 feet, a length on the waterline of 150 feet, a molded beam of 32 feet 5 inches, a draft of 15 feet and a displacement of 642 tons.

Main Saloon

Owner's Bedroom



View of Engine Room from Upper Grating



550 Horsepower Propelling Motor

The power plant consists of two Winton Diesel engines which develop a total of 700 horsepower. Each engine is direct connected to a 225-kilowatt Westinghouse shunt wound generator. Current for propelling the yacht is supplied through the main switchboard to a 550-horsepower Westinghouse electric motor which gives the vessel a speed of 11½ knots without employing her sails. The electric propelling unit was worked out by the designers with suggestions from Commander Fisher of the United States Navy. The yacht has a fuel capacity of 95 tons of oil and stowage space for supplies sufficient for a cruising radius of 11,000 miles.

The Winton Engine Works and the Westinghouse Electric & Manufacturing Company constructed the power plant and driving generators and motors. The ship was built by the George Lawley & Son Corporation at their yards in Neponset, Mass.

Deck House and Cabin Arrangement

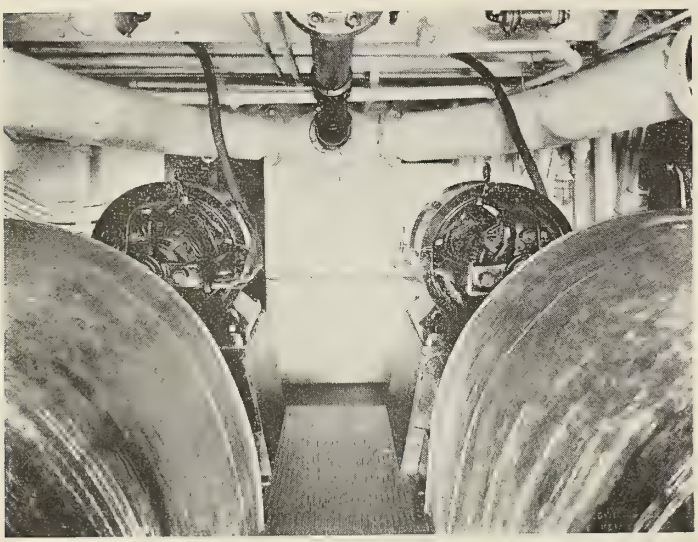
The comparatively small space occupied by machinery in the hull allows a roomy arrangement of cabins below decks and more spacious living accommodations, crew's quarters, capacity for stores and the like than is generally the case in auxiliary yachts, especially if they are steam driven. In addition to these advantages the stack is eliminated allowing space for an extra deck house. The exhaust is at the after end of the boat under water so that soot and gas fumes are carried well away from the yacht.

The main power plant consists of a pair of 6-cylinder 350-horsepower model 24-A Winton Diesel oil engines having a bore of 13 inches, a stroke of 18 inches and an operating speed of 225 revolutions per minute. Each engine is direct connected to a 225-kilowatt Westinghouse shunt wound generator, which in turn operates through a chain drive a 15-kilowatt, 125-volt direct current compound-wound Westinghouse exciter, turning at 1,150 revolutions per minute. This power unit supplies current to a 550-horsepower, 250-volt Westinghouse propelling motor operating at 220 revolutions per minute located in the stern.

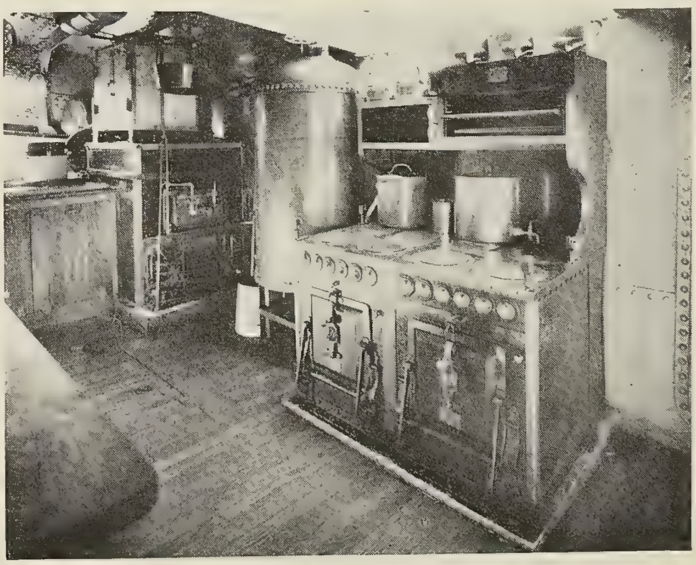
Propeller

The propeller, constructed according to the Bevis patents, is two-bladed, having a diameter of 8 feet 4 inches. The greatest advantage of the twin engine drive installed in the *Guinevere* is its maneuvering ability as well as the possibility of cruising at reduced speed on one engine or at full speed on both engines if it is desired. In the case of engine repairs a single engine and generator unit is able to carry the load while the other unit is shut down.

An interesting feature of the installation is that the generators are not only ring-oiled, as is the usual practice, but provision is also made for flooding them with oil from the lubricating systems of the Diesel engines. This provision is made so that they will operate satisfactorily whatever the list of the ship might happen to be.



Generators and Exciters



Galley, Showing Electric Range

The driving motor is enclosed at its forward end, but an inlet is provided at the top for the intake of cooling air. Centrifugal fans direct connected to a 1¾-horsepower motor furnish approximately 3,500 cubic feet of air per minute for ventilating the propelling motor.

METHOD OF OPERATION

The method of operation for this drive is practically the same as that used in the auxiliary schooner yacht *Elfay*. For cruising at full power the two main generators are connected in series furnishing current to the motor. The generators and motor are in this case arranged for separate excitation at 125 volts on the exciter circuit. The speed of the motor from zero to maximum in either direction is controlled by means of the reversing rheostat which controls the excitation of both generators and thus the generator voltage, which determines the speed of the motor. This arrangement makes it possible to operate the ship at almost any speed desired up to the maximum ahead or astern. It also allows for reversing without interrupting the main circuit.

Unlike the *Elfay* the *Guinevere* power plant is controlled from the engine room by signals from the pilot house. The reversing rheostats are mounted at the rear of the switchboard panel and are operated by a hand wheel suitably marked on the front of the panel board. In addition to the reversing rheostat this panel carries an automatic circuit breaker for overload production, motors, knife switches for the generator and motor field circuit, and a two-pole double-throw knife switch for each main generator armature circuit. By means of the latter switches each generator may be connected in series with the other generator or disconnected, leaving the other generator connected to the motor. This arrangement makes it possible to operate at reduced speed when one generator is shut down or when it is desired to operate the ship at low speed for a considerable length of time. Each of these switches has an extra auxiliary control panel in case that it becomes necessary to use more power than is supplied by the auxiliary generating units.

AUXILIARY EQUIPMENT

The auxiliary equipment aboard the *Guinevere* includes a two-ton Clothel ice machine and a pair of 15-kilowatt generators for auxiliary work, each of which is operated by a 25-horsepower Quayle engine. All other auxiliary equipment throughout the boat, such as bilge pumps, fire pumps, service pumps, ventilating fans, hoists, both anchor and sail, wireless equipment and the like are operated by electric power, no steam being used on the boat. The galley equipment, ovens, heaters, hot pans and the like are all heated by electricity. Electric radiators are used for heating the living quarters and cabins throughout the yacht.

GYRO STABILIZER INSTALLED ON GUINEVERE

To give greater steadiness at sea while sailing under power the *Guinevere* has been fitted with a Sperry gyro stabilizer of the active type. The rotor for the stabilizer is 78½ inches in diameter by 17¼-inch face and weighs about 22,000 pounds. It is designed to operate at 1,700 revolutions per minute. Because of the air friction against the revolving element, which increases almost as the third power of the peripheral velocity when the gyro is running at more than half speed, the casing in which the wheel is enclosed has been exhausted of air to a 15-inch vacuum thus reducing the windage losses and saving about 13-horsepower on the equipment. On the *Guinevere* power is supplied for the driving motors of the gyro from the main generators through the main switchboard. The stabilizer equipment is installed in a special compartment just forward of the engine room.

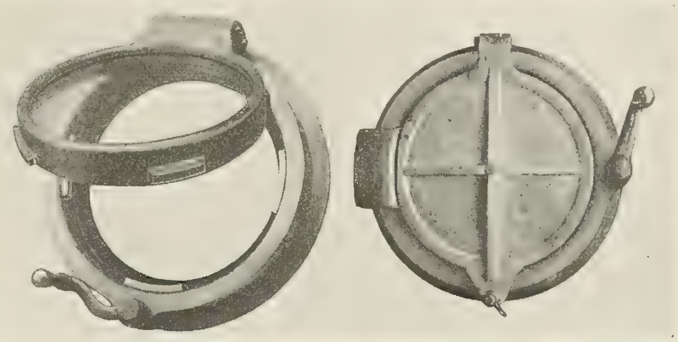
Following out the plan to have the yacht as completely controlled by electricity as possible, she is fitted with a Sperry gyro compass. A repeating compass, electrically operated by the master gyro, is located in the owner's quarters.

The *Guinevere* reently completed her sea trials and a full power run from Boston to New York on which the yacht's performance was satisfactory. She was then fitted out for an extended Atlantic cruise and is now on a run to Cuba.

Air Port Operates on Breech Block Principle

TO facilitate the opening and closing of air ports and to eliminate the glass breakage caused by uneven tightening of tumble bolts the Steward Davit and Equipment Corporation, New York, has produced a new type port which is controlled by the turning of a small handle.

The appearance of the glass frame of this port is similar to the conventional type except that in place of the dogs for tumble bolt nuts it has four fixed wedges on its outer circumference. Inside a fixed frame which is attached to the ship's plating is located a ring gear which has teeth on its outer edge for about a quarter of the circumference. These



Air Port Open Deadlight Closed

teeth are operated by a small pinion attached to a crank handle. On the outer edge of the ring gear opposite the gear teeth is a section made in the form of an interrupted spiral gear which engages with a second spiral gear attached to the cover hinge. The ring gear also has four wedges on its inner circumference which engage the wedges on the glass frame.

To open the port the crank handle is turned and this revolves the ring gear until the wedges clear those on the glass frame. Continuing to turn the handle causes the ring gear spiral to engage with the spiral on the hinge and opens the light. The handle, wedges and spiral gears are timed in such a way that the handle clears the opening light, the wedges clear and then the spirals engage—all in one continuous motion. The light is thus opened and held in position at any angle without any further operation.

To close and tighten the port the motion is reversed; the whole movement being similar to the operation of the breech block on a heavy gun.

British Lines Cut Rates

VICE-PRESIDENT LOVE of the Emergency Fleet Corporation said on December 7 that reports from London that British steamship lines were planning a rate war against United States vessels were based on a rate war between British lines. According to official reports to the board, the action of the British lines was taken without regard to competition by American vessels.

Mr. Love said it appeared that the Ellerman Line, a British company, had announced it would enter the European-Pacific coast trade and that then three other British lines already in that service—the Furness, Harrison and Holt companies—met that announcement with cutting their rates in half.

American Shipbuilding Returns for 1921

Shipyard	Merchant vessels completed in 1921: Number of ships	Total gross tonnage	Total horsepower	Naval vessels completed in private yards in 1921: Number of ships	Total displ. tonnage	Total horsepower	Merchant vessels now under construction: Number of ships	Total gross tonnage	Total horsepower	Naval vessels now under construction in private shipyards: Number of ships	Total displ. tonnage	Total horsepower
American Bridge Company	72	4,390					31	1,202				
American Car & Foundry Company	3	1,200					3	1,500				
Anchor Shipbuilding Company	1		220									
Baltimore Dry Docks & Shipbuilding Company	7	34,477	13,800				3	11,714	4,650			
Bethlehem Shipbuilding Corporation, Limited	30	212,333	89,500	18	22,050	504,000	16	149,265	67,950	34	127,108	460,600
Bath Iron Works, Ltd.	1	6,250	2,200					3,875	2,000			
F. S. Bowker & Sons	1	698										
Chickasaw Shipbuilding & Car Company	7	42,000	21,000									
Consolidated Shipbuilding Corporation				3	1,700	1,800						
Wm. Cramp & Sons Ship & Engine Building Company	2	8,699	6,600	2	2,430	56,000				5	35,500	450,000
Oscar Daniels Company	3	19,768	9,600				1	7,800	4,000			
Dollut & Williams Shipbuilding Company	2	13,600	5,600									
Downey Shipbuilding Corporation	1	550										
Dravo Contracting Company	31	8,121					20	7,009				
Defoe Boat & Motor Works				8	6,500	2,800	4	600	725			
John Eichleay, Jr., Company	4	850	1,100				2	850	1,650			
Electric Boat Corporation				(Does not build except through subsidiaries)								
Federal Shipbuilding Company	8	69,450	26,800									
George A. Fuller Company	4	6,121	12,000									
Globe Shipbuilding Company	2	16,416	3,000									
Great Lakes Engineering Works	1	1,255	3,000									
Groton Iron Works	1	826	400									
Green, Richard T., Company	1	464	400									
Hanlon Dry Dock & Shipbuilding Company							1	1,500	1,000			
The Humphreys Railways, Inc.	1	141	100				1	310	300			
Johnson Iron Works, Dry Dock & Shipbuilding Company, Inc.	6	1,600					2	700				
Kelley-Spear Company	2	3,252										
Kyle & Purdy, Inc.	3	2,250	1,350				1	250	150			
Kanawha Dock Company	1	154	600									
Los Angeles Shipbuilding & Drydock Company	7	56,000	24,500									
The Lake Torpedo Boat Company				3	3,276	3,000				4	4,888	7,200
McClintock Marshall Company	10	7,500										
McDougall-Duluth Company	5	5,200	1,400									
Manitowoc Shipbuilding Corporation	1	1,407	800				1	140	600			
Marietta Mfg. Company	12	12,809	13,800				1	355	400			
Merchant Shipbuilding Corporation	7	42,072	21,150				2	16,000	9,000			
Merrill-Stevens Shipbuilding Corporation	1	300										
Midland Barge Company	5	2,000										
Moore Shipbuilding Company	11	82,800	39,500									
Main Iron Works	4	1,900	4,000				1	1,000	1,000			
Nashville Bridge Company	22	6,150	250				5	1,500	550			
Newburgh Shipyards, Inc.	4	11,935	12,000									
New Jersey Dry Dock & Transportation Company	3	1,672	1,200									
Newport News Shipbuilding & Dry Dock Company	6	77,150	37,200	1	32,600	34,000				4	162,800	454,000
New York Harbor Dry Dock Corporation							2	6,570	3,200			
New York Shipbuilding Corporation	19	206,357	158,600	4	5,892	108,000	4	38,100	26,000	3	108,700	234,600
Pacific Coast Shipbuilding Company	2	18,800	5,600									
Pittsburgh Steel Company	1	1,400										
Pusey & Jones Company	3	11,546	6,000									
Rice Brothers Company							4	1,600				
Riter Conley Manufacturing Company	10	2,500										
Geo. D. Ryan & Son	3	1,040	100									
Saginaw Shipbuilding Company	1	4,250	1,500									
San Diego Marine Construction Company	1	100	120									
Southern Shipyard Corporation	6	1,500										
Southwestern Shipbuilding Company	4	28,500	12,600				2	10,388	5,600			
Spedden Shipbuilding Company	2	1,320					1	325				
Standard Shipbuilding Corporation	4	17,956	9,300									
Standifer, G. M., Shipbuilding Construction Corporation	4	48,000	11,200									
Staten Island Shipbuilding Company	10	16,349	8,100									
Story, A. D.	4	500	100				2	510				
Submarine Boat Corporation	11	24,815	12,800				1	3,545	2,000			
Sun Shipbuilding Company	8	65,227	27,900				5	29,010	11,350			
Tank Shipbuilding Corporation	2	1,250										
Texas Steamship Company	2	7,360	3,000				1	6,702	3,000			
Todd Dry Dock & Construction Corporation	1	3,620	2,400							3	21,300	270,000
Union Shipbuilding Company	2	13,122	6,400				2	13,000	6,400			
Virginia Shipbuilding Corporation							1	6,060	2,500			
Vinyard Shipbuilding Company	4	741	1,204				2	640	820			
Vulcan Iron Works, Inc.	(6 triple expansion, 6 compound and 2 quadruple expansion engines, with a total horsepower of 18,500.)											
Charles Ward Engineering Works	1		1,800				2	660	1,050			
Winnisimmet Shipyard, Inc.	1	772	700									
Totals	399	1,140,785	622,494	39	74,448	709,600	129	322,680	155,895	53	460,296	1,876,400

American Shipbuilding Returns for 1921

Output of Merchant Tonnage Three Times Pre-War Record—Much Repair Work in Sight—Important Developments Looked for in 1922

WHILE the year 1921 will go down in the annals of shipbuilding as one of the lean years when contracts for new construction were few and far between, this does not mean that our shipyards have been idle for the past year. On the contrary, they have produced a total of 1,140,785 gross tons of shipping, which is approximately three times the best record of the years 1900 to 1915 inclusive and which approaches very closely the output for 1916 when the boom due to the war began. Practically all of this tonnage, however, was contracted for in the latter part of 1920.

The falling off of new business in 1921 was not confined to shipbuilding alone but extended to all lines of industry due to the exceptionally unsettled state of the world's markets and the declining volume of foreign commerce.

Conditions were further aggravated by the large number of Government owned vessels laid up and the failure of the Government to adopt a definite policy with regard to our merchant marine.

That officials in Washington at the present time are fully alive to the needs of the world is demonstrated by the initiative shown in promoting the Limited Armament Conference, with a view to lightening the military burden of all nations to the benefit of commerce, and by seriously taking up the question of ship subsidies as a means of placing our merchant marine in a position to meet foreign competition in world trade.

Armament Conference

The limited armament conference now under way in Washington, while at first viewed with alarm by the shipbuilders of the United States, is assuming an aspect which may prove a distinct boom to the merchant marine.

Definite peace arrangements consummated as a result of this International Conference will go a long ways toward stabilizing business all over the world with a resulting increase in foreign trade that will quickly reduce the idle tonnage now gracing so many of our ports. This may be better realized from the fact that, based upon the pre-war rate of increase, there is a deficiency in world tonnage at the present time amounting to some two and a quarter million tons. As trade returns to normal it is evident that this tonnage will have to be made up and this figure will be further augmented on account of a large number of the older vessels being scrapped.

Subsidy

The question of some sort of a subsidy for the American merchant marine to offset the difference in standards of personnel, which exists between the United States and foreign countries, seems very likely to be settled by the early part of 1922.

A special committee of shipowners, operators and builders has been working on a plan for subsidies for several weeks past and President Harding has requested this committee to have its report in his hands by January 1. The President, it was learned, plans to take up the question of ship subsidies in a special message to Congress the first week in January.

The question of a subsidy will open the whole subject of our merchant marine and undoubtedly result in the adoption of definite policies which will stimulate interest and lead to important developments in our water borne transportation systems.

That subsidies were responsible for the success of early American transatlantic lines and also for the present position of pre-eminence of the British steamship lines is shown by Winthrop L. Marvin on page 5 of this issue.

Tonnage Now Under Construction

According to the latest figures available, there are at the present time 322,680 gross tons of steel merchant vessels under construction in the United States. This tonnage, while seemingly low when compared with the record years of the war, exceeds the annual output of any year between 1900 and 1915 with the exception of 1906 when 348,555 and 1907 when 450,017 gross tons of shipping were produced.

Passenger Ships

It has been stated that the United States needs at least one hundred fast passenger vessels to balance its huge fleet of merchant ships.

The present plans of the Government will increase the importance of this class of vessels and, with the adoption of limited armaments and the granting of a subsidy, there is no doubt that a number of vessels of this type will be included in the merchant construction work for 1922.

Repair Work

The large number of idle ships now in our ports is an assurance of busy times ahead for the ship repair yards. Every one of these vessels must be overhauled and reconditioned before again being placed in service. Many will be fitted with new machinery.

The motorship has made an enviable record for economical operation in the months of keen competition just passed and this type of propulsive power will undoubtedly be installed in a number of these vessels.

Conversion of Battle Cruisers

The conversion of the six battle cruisers, now under construction for the Navy, into fast passenger vessels is also gaining favor. These vessels would be scrapped under the armament limitation plan and their conversion would provide a nucleus for a future fleet of passenger ships in addition to offsetting the monetary loss involved. It is estimated that these vessels can be fitted to provide accommodations for from 3,200 to 3,500 passengers in addition to providing for the carriage of at least 2,500 tons of freight. These vessels would provide a nucleus for a future fleet of passenger ships and would undoubtedly be well patronized as affording the greatest amount of safety afloat due to the unusual watertight subdivision of the hull.

Ship Breaking-Up Industry

Another possible development of the Limited Armament Conference will be the establishment in this country of a number of firms for the purpose of breaking up and salvaging material from vessels discarded by the Navy.

This will be a new business undertaking in the United States, and judging from some of the results obtained in Europe is likely to prove a profitable undertaking.

While there has been an expression of pessimism regarding the shipbuilding situation in many quarters, the returns for the year just ended show a gratifying figure for tonnage constructed and the new developments now taking place indicate a normal business for 1922.

Shipping and Shipbuilding in Great Britain in 1921

By W. H. Wendon

The year which has just closed has been one of keenest anxiety to those engaged in all branches of shipping—whether builders, engineers, repairers, owners or brokers. Following the artificial boom conditions during the period of the war and immediately after, the weak points in the armor of the newly-established companies were clearly shown up, with the result that failures have been frequent. More than that, many companies whose affairs have not already been placed in the hands of a receiver are shivering on the brink of attaining that unenviable distinction.

IT is noteworthy to reflect that the opening of the year 1921 practically synchronized with the dawn of disillusionment in the minds of the majority of those dependent on industry. It was not unnatural, therefore, that, so far as shipowning was concerned, schemes should be mooted having as their object the improving of the freight situation. The most concrete plan, and that which aroused the greatest interest, was propounded in March by Sir Owen Philipps, the newly elected president of the Chamber of Shipping of the United Kingdom.

Schemes for Improving Freight Situation

Pointing to the fact that at that time there was an excess of no less than ten million tons of merchant shipping as compared with 1914, Sir Owen Philipps urged in no uncertain manner the scrapping of the unusually large number of old vessels of all countries, which craft, owing to their age, construction or design, must be unsuitable to compete in the strenuous times that lie ahead. Sir Owen Philipps further contended that the sooner these obsolete vessels were broken up, the better for all concerned and, in the interests of both shipowners and shipbuilders and their employees, he expressed the hope that the industry of the shipbreaker, which had fallen into abeyance since 1914, would again become active, as otherwise he feared that shipbuilders in Great Britain and abroad would witness a dearth of new orders for some time to come.

Shipbreaking Industry Revived

As all the world knows, this opinion has unfortunately been borne out by events. The keenness of Sir Owen Philipps' view that the older vessels should be sent to the shipbreakers is emphasized by his recent declaration that, in addition to the older vessels, the inferior new ones, built more or less for emergency purposes during the war, ought, in his opinion, to be broken up. The materials of which these vessels consist could, it is true, be made use of in some way or other, but against the adoption of this course there is at present one very real difficulty and that is that the cost of labor for breaking up a vessel often nearly equals the value of the material. But time, the great healer, will probably put matters right in this respect.

Voluntary Laying Up of Steamships

Another great factor in the attempt to adjust the unsatisfactory tonnage position has been the endeavor to formulate some workable scheme having as its object the voluntary laying up of steamships. Notwithstanding the fact that a very large proportion of the tonnage of the world continues compulsorily idle, there is still a great excess over the world's needs. It will be recalled that shortly prior to the war the freight market was flooded with tonnage and a scheme for a reduction in the number of the vessels in commission was formulated and ready for operation. But with the outbreak of war and the universal demand for steamship space, coupled with the enormous losses during the submarine campaign, every ship found its billet and the laying up plan was shelved. The subject came into prominence again in May last at the meeting in London of the Baltic and White Sea Conference. Sir William Noble, the president of the Conference, reminded the delegates that as far back as 1905, during a similar post-war depression, a minimum scale of freights was created. While this scale did not achieve all that was expected, it did arrest the fall and enable steamers to be employed. I mention this as a matter of historical interest, but I would add that, while from time to time during the past year the idea of laying up such a quantity of tonnage as would impel an increase in freight rates has been mooted, shipowners still seem as far off as ever of coming to some practical result.

The throwing on to the market of an immense amount of ex-German steamship tonnage has necessarily created dissatisfaction both among shipowners and shipbuilders. The very fact that about 400 of the ex-enemy vessels allocated to Great Britain have been disposed of should give a vivid indication of the chaos which occurred in the British shipping sale market. During the first nine months of the year shipbrokers were at their wits' ends as to the best means of conducting their business, but towards the close of 1921 "a certain liveliness" was discernible, one firm of brokers carrying through the then amazingly large number of 21 transactions during a period of three weeks.

Which brings me to shipping values. The transactions which have been recorded during the past year have been, to say the least, phenomenal.

Shipping Values

The most sensational deal was undoubtedly that connected with the fleet of the ill-fated Western Counties Company. The history of this concern is, indeed, a remarkable one. Prior to the late boom the company was the modest possessor of a few cargo steamers, but in December, 1919, it acquired the famous Moor Line fleet of thirteen cargo carriers, aggregating 82,000 tons deadweight. Notwithstanding that these boats averaged 11½ years of age, the expenditure of no less than £1,804,000 was required, equivalent to £22 per ton on the vessels' deadweight carrying capacity. In order to provide the funds for this huge purchase, the company increased its share capital from £274,000 to £1,250,000, the balance of the purchase price being secured by the issue of debentures. Within three months of the purchase of the Moor Line boats the Western Counties became the owners of the Sutherland fleet of 11 cargo steamers with an aggregate carrying capacity of 75,000 tons. For these vessels the expenditure of £1,825,000 was necessary. In order to carry through this acquisition, a further £1,000,000 was needed, and, as before, the public responded nobly, the issue being largely oversubscribed. With the crash in freight rates the company failed and in August eight of the boats were sold by order of the mortgagee for £266,150, as against £1,450,000 paid for them in February, 1920.

The Maindy Shipping Company, a Cardiff enterprise similar to the Western Counties, also met with a disastrous result, its fleet of ten steamers being seized by the mortgagees

in consequence of the company being unable to meet its commitments.

Shrinkage of Ship Values

As being representative of other remarkable shipping sale transactions which have taken place during the past year, mention should be made of the following: The *Michael Bistis,* of 5,850 tons deadweight, built in 1890, changed hands in 1919 for £160,000. In June last the most that could be obtained for her was £4,500. The Commonwealth Government's *Vermont,* of 6,800 tons deadweight, built in 1900, realized £110,000 when disposed of in 1916, and no less than £170,000 in May, 1919. During the past year she was again sold, but on this occasion only £15,000 changed hands. Two of the steamers owned by T. G. Beatley & Son (another firm whose financial affairs have been before the Bankruptcy Court) have provided instances of great depreciation in values. Their *Madame Midas,* of 3,624 tons deadweight, built in 1904, realized £16,750 when sold in December, 1909; £23,000 in November, 1912, and £63,750 in September, 1918. In November last, however, she was put up by auction in London and fetched only £11,350. The *Madame Brooke,* which was disposed of in March, 1917, for £37,500, realized only £9,000 in November last. These instances of depreciation could be multiplied many times, but suffice it that they are indicative of the melancholy state of the shipping sale market during the past twelve months.

Earnings of Steamship Companies

The earnings of steam shipping companies during 1921 have been on a much lower scale than of late years and, especially in the case of Cardiff companies, dividends have been noticeably attenuated. The position may be gaged from the fact that such efficiently managed companies as the P. and O. and Royal Mail Steam Packet have limited their distributions. The P. and O. was, perhaps, the bigger shock of the two, as it has always been the avowed practice not to distribute more to the deferred shareholders in any one year than can be maintained in future years. In the existing depression, however, the action of the managers is quite understandable and the course they have adopted is, after all, a wise one in reducing the distribution rather than paying more than the company can really afford.

The prices of shipping shares have not unnaturally been affected during the slump and in this connection the following table showing the values of the shares of representative companies in March, 1920, twelve months later and in December last, should not be without interest:

	Nominal value of shares	March, 1920	March, 1921	December, 1921
African S. S. Co.	£20	£33	£21	£23
Argentine Nav. Co.	1	1⅛	½	¼
Cairn Line	1	1¾	15-16	13-16
Clan Line	10	31½	9	8½
Cunard Line	1	2 3-16	15-16	⅞
Furness Withy	1	2⅝	1⅛	1⅛
Houlder Line	5	17	9	9
Indo-China	5	53½	35	33¼
Khedivial Mail	1	5½	5½	5½
King Line	1	2	1⅛	1
Orient Line	5	20	7½	9
P. and O. Co.	100	560	320	282
Royal Mail S. P. Co.	100	195	90	78
Anglo-European Co.	1/—	7/6	9d.	1½d.
Australasian United Co.	£50	£30	£40½	£40½
Britain S. S. Co.	10	46⅛	20½	20⅜
Canada Steamship	100	80	35	21
Court Line	20/—	44/—	28/1½	25/4½
Cressington Co.	20/—	42/—	26/—	27/1½
London-Am. Maritime Co.	20/—	36/3	16/—	16/—
Western Counties Co.	20/—	22/—	5/—	½d.

Theft and pilferage have been the subject of keen discussion throughout the whole of 1921 and great steps forward have been made in eradicating this world-wide evil. The policy of imposing a fine on the offender has been proved repeatedly to be of no deterrent value. The infliction of a sentence of imprisonment is the only effective manner of dealing with the miscreants.

Ministry of Shipping Abolished

The Ministry of Shipping came to an end during the past year. During its lifetime it was responsible for ordering 821 vessels in the United Kingdom and abroad; 279 of these were transferred to private owners for completion, the orders for 126 were cancelled, involving an expenditure by way of compensation of £500,000, and the remaining 416 boats were completed. Twenty-three of the latter were sunk, 15 were transferred to the Admiralty service as oilers and the balance of 378 were sold to private owners.

The total cost of the 228 ships built in this country was £36,481,000 and the selling price £47,591,000, showing a profit of £11,110,000; 122 ships built abroad cost £26,884,000 and were sold for £18,289,000, or a loss of £8,595,000, the net profit on the 378 ships being £2,515,000. If, however, 5 percent depreciation had been allowed, the net profit would have been increased from £2,515,000 to £5,122,000, while if a similar number of ships had had to be ordered from neutrals, it would have entailed an additional expenditure of £27,000,000.

There were larger receipts from the liner requisition scheme to the extent of £11,000,000, additional earnings of ex-enemy ships amounted to £9,600,000, and a further £579,000 was received from miscellaneous receipts, sales, etc. Recoveries from Allies, Dominions and trading developments totaled £13,250,000, sales of ships £1,680,000, and sales of shipyards and materials £70,000.

It will be gathered from the foregoing that the Shipping Controller's Department resulted in a substantial profit to the State.

Orders for New Ships Lacking in 1921

One of the most melancholy features of the shipbuilding and engineering trades in the past year has been the almost complete absence of new orders. Most of the yards have been pretty well occupied, but this activity is only traceable to the working off of the orders contracted many months ago.

The strike of shipyard joiners was particularly disastrous. The cessation of work commenced as far back as August, 1920, when the whole of the shipwrights employed in repairing on the Mersey struck work, without the authority of the executive of their trade union, to enforce the demand for a minimum wage of £6 a week. They eventually returned to work without gaining their object but, in the meantime, the loss of 400,000 working hours had taken place and the direct result of the men's action was to divert many important contracts to foreign countries. On December 1, 1920, the men again struck and then for many months the ship joinery industry of the country was in a state of chaos. Messrs. Cammell, Laird & Company, to mention one firm only, lost something like 700,000 working hours in consequence of this long drawn out dispute.

Watertube Boilers for Merchant Vessels

The suitability of watertube boilers for all classes of merchant vessels was given a good deal of prominence during the past year by the leading technical authorities. Sir James Kemnal raised the matter by reading a widely discussed paper before the North East Coast Institution and the subject was taken up by Mr. Waldie Cairns, who intimated that if ships sailed in good boiler water he might fit nothing but watertube boilers. For ships with high power of a large number of boilers—even sailing salt seas—he would consider watertube boilers favorably; but for moderate powered ships with, say, up to the equivalent of four large cylindrical boilers, he would like to know a good deal more about actual

performances before recommending steam generators of the type.

He adopted this standpoint mainly on the question of the weight of water in the system. In a ship of moderate power the weight of water had two rather important functions. A good weight of boiler water acted, for instance, as a "thermal fly-wheel," levelling up some of the inequalities in firing and fire-cleaning, which were very appreciable in moderate powered ships. The other function of a good weight of water was the capacity to take up, without rapid development of trouble, such quantities of sea water as might leak into the system from failure of a condenser tube or a condenser tube packing, which, even if detected, could not always be remedied quickly.

Taken all in all, Mr. Waldie Cairns is of opinion that there is good reason for caution. Moreover, bearing in mind the extra 100 tons deadweight capacity which Sir James Kemnal had indicated for a boat of 2,000 horsepower, this, Mr. Waldie Cairns believes, is not a great matter compared with the elasticity, handiness and general reliability of the old cylindrical boiler.

New System of Construction for Oil Tankers

Another technical feature of the past twelve months has been the adoption of a new system of construction in relation to oil tankers. The difficulty with which shipbuilders are confronted in building this type of vessel is to make a good connection of the centerline and the thwartship bulkheads, the present arrangement being expensive and altogether unsatisfactory. The new system referred to is claimed to achieve a perfect joint at a lower cost. It consists of a vertical plate lapped on the center keelson and extending to the oil deck with two tee bars, one on either side. The tee bars extend from keel bar to oil deck and form a "cross section" to which the horizontal plating of the centerline and transverse bulkheads is connected. This "cross section" forms a metal-to-metal joint, dispensing with the injection of cement or other substances.

It is claimed that by its use (1) all difficult riveting is eliminated; (2) three-ply riveting is reduced by 50 percent; (3) calking is reduced by 50 percent; and (4) the cost of erecting is reduced. The structure is so light that it can be erected with ordinary facilities. The bulkhead stiffeners and knee connections can be hydraulically riveted to the bulkhead plating on the ground before erection, leaving only the seams of the bulkhead plating to be riveted in position.

Another advantage is that the narrow plate, fore and aft, connected to the longitudinal bulkhead plating by a double-riveted lap increases the strength of the centerline bulkhead—which is, of course, of very great importance in oil carrying vessels in order that they may withstand the hogging and sagging stresses to which they are subjected.

Harland and Wolff's Increased Facilities

A mild sensation was created towards the close of the year when it became known that the great shipbuilding and engineering firm of Harland and Wolff, which already possessed yards at Belfast, Glasgow, etc., had undertaken a great repairing contract at the Port of London. It is noteworthy to recall that many years ago the shipbuilding and repairing yards of the Thames were one of its "glories," but one by one the companies were weeded out until only the smaller firms remained. However, Messrs. Harland and Wolff now have in their possession the right to do all the repairing and maintenance work required by the Port of London Authority and are under obligation to spend at least £300,000 in bringing the plant up to date. Despite the depression existing in all branches of the industry, Messrs. Harland and Wolff are making progress with their latest acquisition.

In regard to new vessels, on which subject many columns of this journal might be occupied, particular interest, perhaps, attaches to the twin screw Anchor Liner *Cameronia*, the first large liner to be laid down and afloat after the armistice, inasmuch as her launch in the remarkably short period of 9½ months from the laying of the keel constituted a record in British shipbuilding.

New Ships

The *Cameronia* represents a new type of intermediate Atlantic liner, embodying all the features hitherto exclusively found in "ocean greyhounds" and propelled by machinery of the most recent type, calculated to give the maximum economy of operating cost under all service conditions. The propelling machinery, supplied by Messrs. Beardmore, also the constructors of the hull, consists of two sets of Brown-Curtis turbines, each comprising one high pressure, one intermediate pressure and one low pressure turbine, astern turbines being incorporated in each intermediate and low pressure casing. The machinery develops at full power 13,500 shaft horsepower, sufficient to maintain a speed of 17 knots in moderate weather.

Both from shipowning and shipbuilding points of view, the formation of a company called the "British Trade Ship, Limited," with an unusually influential board of directors, was an outstanding event of the year. The object of the promoters of this scheme was to construct an exhibition ship *par excellence* and, if the indications are trustworthy, those responsible for the vessel will achieve at least this part of their program. The boat is now building by Messrs. Swan, Hunter and Wigham Richardson, Ltd., who are largely interested in the scheme. The intention is to send the vessel to the chief ports of the world in 1923 as a method of attracting business of all descriptions to commercial centers in the British Empire. The boat is to have a gross tonnage of 20,000 and a length of 550 feet, her extreme breadth will be 74 feet 9½ inches and her depth, molded, 44 feet 6 inches to the shelter deck. Her cruising speed in exhibition trim will be in the neighborhood of 12½ knots.

International Shipping Conference

In view of the complex problems which have confronted shipowners during 1921, it was not unfitting that a great International Conference, in which American delegates took a prominent part, should be held in London towards the end of the year. The leading questions of the day were discussed at length, and some momentous decisions were arrived at. The matters dealt with included the much discussed Hague Rules, the load line regulations, the carriage of wood cargoes on deck and the safety of life at sea. In regard to the last-mentioned, general satisfaction is expressed in responsible shipping circles in Great Britain that at last a serious attempt is apparently to be made to revise the Maritime Convention of 1914, a measure which has been postponed regularly at intervals of six months, and at the moment is under postponement until July 1, 1922. In the light of the experience gained during the war, it is not too much to hope that practical results will be forthcoming in the near future.

Another matter of world wide interest which has come into special prominence in the past year has been in regard to the dangers arising from floating oil in harbors and docks. After serious consideration of all the difficulties attending this important question, a representative meeting of shipowners agreed that it was essential in all cases that the provision, either directly or by contract, of barges or other convenient receptacles by the port authorities should be compulsory. For a long time there was disagreement on this point between shipowners and the dock and harbor authorities, but eventually the latter agreed that, although they could not submit to a statutory obligation to provide suitable receptacles, they would in fact do so at all ports where such receptacles were necessary. The shipowners accepted this compromise and it is more than probable that much good in regard to the modification of the floating oil evil will result.

Motor Passenger Liner Aba in Belfast Harbor

The First Motor Passenger Liner

The Aba of 8,000 Gross Tons and 6,400 Indicated Horsepower Assigned to Liverpool-Africa Route

By A. P. Chalkley

THE motor cargo ship has now become so common that new vessels fitted with oil engines attract comparatively little attention. Passenger liners, however, come within a different category and it is natural that the first vessel of such a class should arouse unusual interest among the shipping community.

To the well-known shipowners, Elder Dempster and Company, Liverpool, belongs the honor of placing the first motor passenger liner into regular service, the new vessel, the *Aba*, having sailed from Liverpool to Africa on her maiden voyage on November 16, 1921. This is a development of the greatest importance, for although she is not of the dimensions and speed of the large, modern transatlantic liner, the *Aba* is a comparatively large vessel as the following details will indicate.

Length, between perpendiculars	450.5	feet
Breadth	55.8	feet
Depth	36.6	feet
Gross tonnage, about	8,000	
Indicated horsepower	6,400	
Speed, knots	14	
Passenger accommodation (first class)	220	
" " (second class)	105	
" " (third class)	35	

The *Aba* was built in 1918 by Barclay Curle and Company on the Clyde as a cargo vessel, being then the *Glenapp*, and was in service for some months before her new owners, the British and African Steam Navigation Company (for whom Elder Dempster and Company are managers) placed her in Harland and Wolff's hands for conversion to a thoroughly up-to-date liner suitable for the regular passenger trade, the cargo capacity being cut down to 1,000 tons. She would have been completed many months ago had it not been for the prolonged delay to all vessels of this type caused by the joiners' strike at all British shipyards.

The Machinery

Before dealing with the passenger accommodation, which is equal to that of any transatlantic liner and contains many interesting novelties, a description may be given of the propelling and auxiliary machinery. The total power of the two main engines is 6,400 indicated horsepower, which is greater than that of any motorship afloat except for two motor cargo boats, the *Glenogle* and the new *Glenapp* owned by the Glen Line, in which engines of the same designed output are fitted. The motors in the *Glenapp* are of the Burmeister and Wain type and were built by Harland and Wolff of Glasgow. They each have eight cylinders, 29½ inches in diameter with a stroke of 43 5/16 inches, full power being produced at 120 revolutions per minute.

Burmeister and Wain engines are so well known that a few brief details of the design will suffice. It may be added that in general principle of construction, apart from the higher power and increased number of cylinders, they resemble fairly closely the machinery of the *William Penn*. They are of the four cycle type with the usual inlet, exhaust and fuel and starting valves, located in the cylinder covers, operated by long push rods which derive their motion from a camshaft, arranged about half way between the engine room floor and the top of the cylinders. On the camshaft are two side-by-side cams for ahead and astern running respectively. The reversing mechanism con-

trolled by a lever at the starting platform is so designed that when it is put into motion, by the reversing lever, it causes the push rods to be lifted off the cams, the camshaft to be moved, so that the astern cams come below the levers, and finally the push rods again to be brought into contact with the cams.

Starting Mechanism

Unlike most Diesel motors, the engines are each provided with two three-stage air compressors, supplying blast injection air at about 1,000 pounds per square inch while the starting air pressure is 360 pounds per square inch. Most of the other main engine auxiliaries are, however, separately driven by electric motors, except the eight small fuel pumps. After the reversing lever has been operated so that the valve gear is in the correct position for ahead or astern running as the case may be, the engine is started up by the movement of a single starting lever which admits air to the cylinders through the starting valves. The same lever also turns the cylinders over to fuel and speeds up the engine, thus giving a very simple control.

New Features of Design

There are one or two points in the design of the motors, which, so far as the writer is aware, have not been adopted previously on Burmeister and Wain engines.

Some of the cylinder covers have been made in two sections, the lower portion alone being subjected to a very high temperature. This section is spigotted into the upper part containing the valves. The object is that, should a crack develop, it will arise in this lower portion which can thus be more readily and cheaply renewed than if a whole cylinder cover had to be replaced.

A second important innovation lies in the construction of the pistons. Between the outer part of the piston, in contact with the liner, and the inner part, which is water cooled, there is an annular space around which air is allowed to circulate. The effect is a combination of water and air cooling which it is understood provides a better design than the usual system which is wholly water cooled. As is common practice with Burmeister and Wain engines piston cooling is effected by fresh water, a supply tank being arranged below the engine room floor. This piston cooling water circulates around a sea water cooler of moderate dimensions, but the cylinder jackets are supplied by sea water.

The spares carried for the main engine comprise two covers, two pistons, various valves and a number of minor accessories.

Electrical Auxiliary Machinery

As might be anticipated in a modern motor passenger liner, steam driven auxiliaries in the engine room and on deck are notable by their absence. A very small donkey boiler of the Cochran vertical type indeed comprises the whole steam installation, the object of this being for the provision of steam to the thermo tanks on deck by means of which hot air is supplied to the cabins and the dining saloon when the ship is in a cold climate. The only steam driven auxiliary is a small air compressor fitted only for emergency.

The electrical installation is very complete, as may be gathered from the fact that four electricians are carried. On deck are ten electric winches, an electric windlass, half a dozen electric exhausting fans and an equal number of variable speed electric motors driving fans in connection with the thermo tanks for the supply of warm air or fresh air to the cabins as required, this is delivered to a series of ducts, arranged with louvres in all of the cabins as well as the dining saloon. Electricity is used throughout the galley for cooking, while the bakery and the laundry are also supplied with electrically operated machines, even such details as the knife cleaning and boat cleaning machines being coupled to electric motors.

Apart from the thermo tank system of heating previously referred to, the main saloons are supplied by a new form of electric vapor heater which is used in connection with the electric plugs, in a similar manner to the normal electric radiator. The method of operation is, however, different, for the electricity is utilized for raising steam in a self-contained steam radiator. This is a new system which is now adopted for the first time and which it is believed is specially applicable to motorships where electricity is employed to such a large extent.

In the engine room a very large number of electric motors is required. The main auxiliary compressor, of which only one is installed instead of the usual two, is a three stage air high pressure machine driven by an 80 horsepower motor. The piston cooling pump is of the reciprocating type driven by a motor of 10 horsepower while for lubricating there are three electrically operated gear pumps. Salt water circulation for the cylinder jackets is effected by two electric rotary pumps, while the bilge pump, general service pump, fuel pump, turning gear and the DeLaval oil separator are all driven electrically. A large refrigerating plant has been installed of the CO_2 type and this comprises duplicate compressors and brine pumps.

Generally speaking when the ship is at sea, it is estimated that 300 kilowatts will be required and sometimes more. The electric generating plant is therefore on a large scale and there are three sets installed each with an output of 300 kilowatts driven by a four cylinder Harland and Wolff Diesel engine of 320 brake horsepower running at 210 revolutions per minute. The power is delivered to a very large switchboard at 220 volts and this pressure is used throughout the ship, not only for power but for lighting purposes.

Fuel Consumption

The fuel consumption of the ship is estimated at 20 tons per day which compares very favorably with 90 tons of coal required on a corresponding coal fired steamer and some 50 or 60 tons of oil which would be needed on a vessel equipped with oil fired boilers. The fuel tanks between the shaft tunnels have a capacity of 750 tons—sufficient for a voyage of 37 days' duration at full speed—and as on the round trip the vessel will be under way only for about 30 days there is ample bunker capacity for the whole voyage from Liverpool to West Africa and back.

Passenger Accommodation

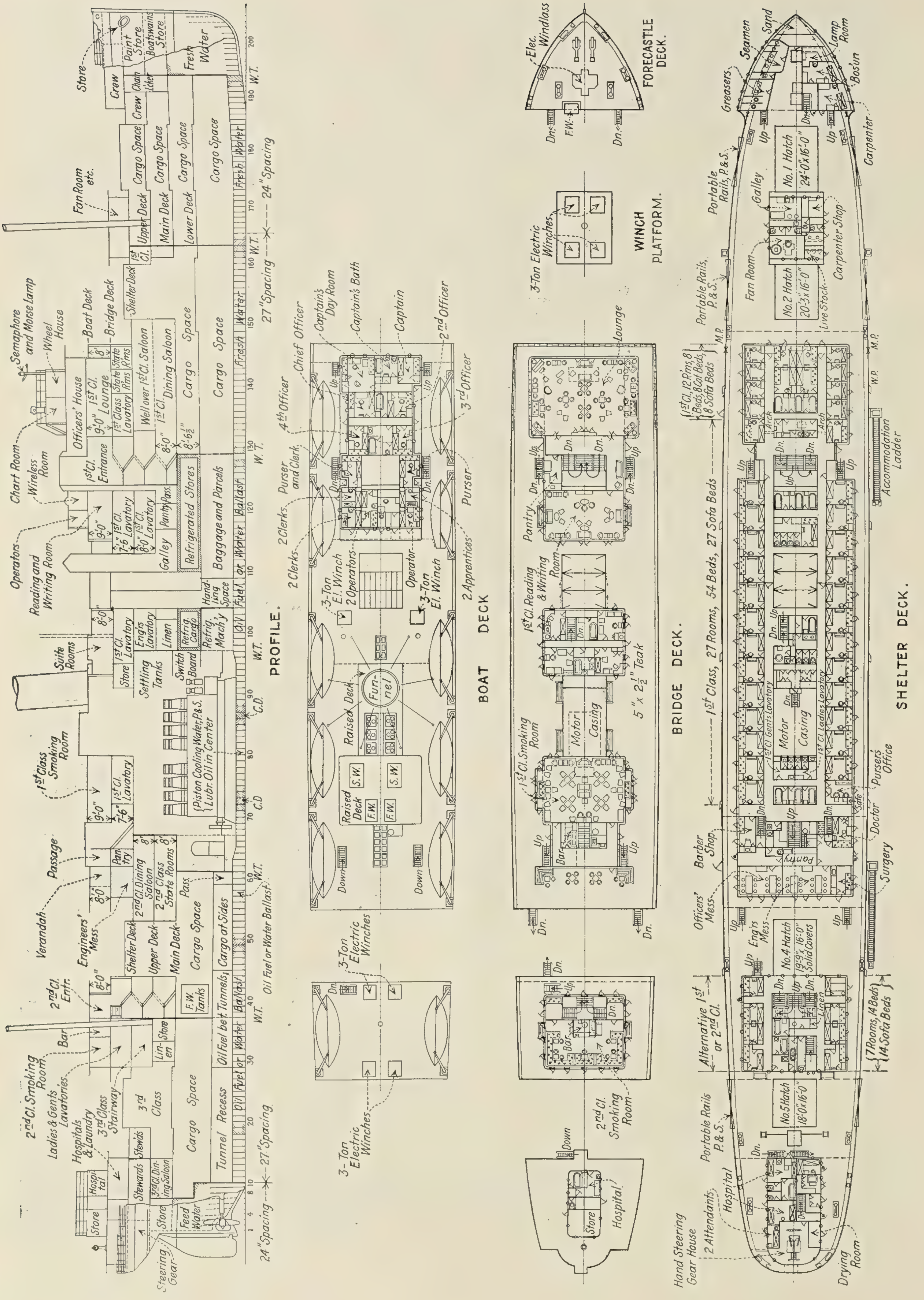
The aim of the builders and owners has been to provide passenger accommodations equalling in luxury and comfort that which is obtained on the finest liners crossing the Atlantic.

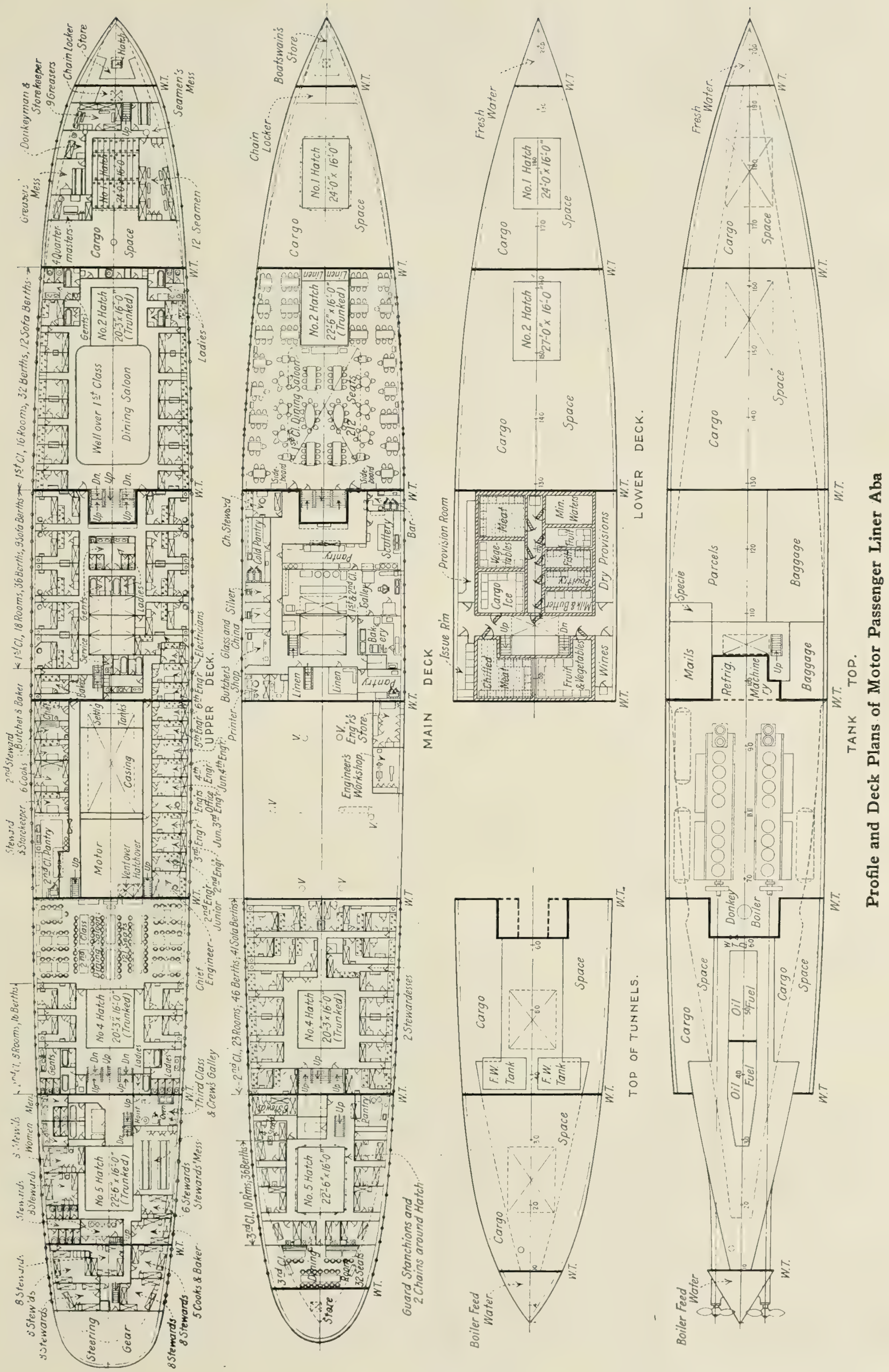
The first class dining saloon which seats 220 passengers at small tables is arranged on the main deck right forward and occupies the whole width of the vessel, its height in the center reaching to the shelter deck. It is finished in white with gilt decorations and wedgewood placques somewhat in the Adams style, the furniture being of oak. On the same deck is the galley, bakery and all cabins required in connection with the supply of food while at the after end is the second class dining saloon seating about 100 people.

The other first class public rooms are all on the bridge deck comprising a first class lounge forward, a reading and writing room, and a smoking room right aft. The lounge is panelled in sycamore with carving and is fitted with wicker chairs with tapestry cushions while a piano is provided. The reading and writing room is painted grey and has a number of mahogany writing tables, the chairs and small tables being of wicker, while tapestry cushions are used throughout. The smoking room is of oak and like the lounge has an attractive electric fire with a tapestry panel above. Aft of this smoking room is an open air veranda and on the same (bridge) deck are two special suite cabins

Interior Views of Motor Liner Aba

(1) First Class Reading and Writing Room; (2) First Class Dining Room; (3) First Class Smoking Room; (4) First Class Lounge; (5) Forward End of Engine Room, Showing Lubricating Pumps for Main Engines; (6) Starboard Side of Engine Room, Showing Auxiliary Generating Sets; (7) Top Platform, Showing Rocking Levers on Main Engines; (8) Lower Platform, Showing Maneuvering and Reversing Gear.


PROFILE.
BOAT DECK
BRIDGE DECK.
SHELTER DECK.
FORECASTLE DECK.
WINCH PLATFORM.
24"Spacing
27"Spacing.
27"Spacing
24"Spacing
Oil Fuel or Water Ballast
Store
Paint Store
Boatswains Store
Fresh Water
Crew
Chain Lker
Cargo Space
Fan Room etc.
Upper Deck
Main Deck
Lower Deck
Shelter Deck
Bridge Deck
Boat Deck
Semaphore and Morse Lamp
Wheel House
Officers' House
1st Cl. Lounge
1st Class Lavatory
State Rms
Well over 1st Cl. Saloon
1st Cl. Dining Saloon
Chart Room
Wireless Room
1st Cl. Entrance
Refrigerated Stores
Baggage and Parcels
Operators
Reading and Writing Room
1st Cl. Lavatory
Pantry
Pass.
Galley
Handling Space
Suite Rooms
Store
Settling Tanks
Engrs Lavatory
Linen
Refrig. Cargo
Refrig. Mach'y
Switch Board
1st Class Smoking Room
Piston Cooling Water, P.&S. Lubr. Oil in Center
Passage
Verandah
Engineers' Mess
2nd Cl. Dining Saloon
2nd Class State Rooms
Cargo at Sides
2nd Cl. Entr.
F.W. Tanks
Oil Fuel bet. Tunnels
Bar
2nd Cl. Smoking Room
Ladies & Gents Lavatories
Hospitals & Laundry
3rd Class Stairway
Linen
3rd Class
Stewards
3rd Cl. Dining Saloon
Hospital
Tunnel Recess
Feed Water
Steering Gear
Chief Officer
Captain's Day Room
Captain's Bath
Captain
2nd Officer
3rd Officer
4th Officer
Purser and Clerk
Purser
2 Clerks
2 Apprentices
3-Ton El. Winch
2 Operators
Operator
Raised Deck
Funnel
3-Ton Electric Winches
Down
Lounge
Pantry
1st Cl. Reading & Writing Room
5" x 2½" Teak
Motor Casing
1st Cl. Smoking Room
Bar
Up
Dn.
2nd Cl. Smoking Room
Hospital
Elec. Windlass
F.W.
Seamen
Sand
Greasers
Lamp Room
Bos'un
Carpenter
No. 1 Hatch 24'-0"x16'-0"
Galley
Portable Rails, P.&S.
Carpenter Shop
Fan Room
No. 2 Hatch 20'-3"x16'-0"
Live Stock
1st Cl. 12 R'ms, 8 Beds, 8 Cot Beds, 8 Sofa Beds
1st Class, 27 Rooms, 54 Beds, 27 Sofa Beds
Accommodation Ladder
1st Cl. Gents Lavatory
1st Cl. Ladies Lavatory
Pursers Office
Safe
Doctor
Surgery
Barber Shop
Officers' Mess
Engrs Mess
No. 4 Hatch 19'9"x16'0" Solid Covers
Alternative 1st or 2nd Cl.
7 Rooms, 14 Beds, 14 Sofa Beds
No. 5 Hatch 18'0"x16'0"
Portable Rails P.&S.
Hospital
2 Attendants
Hand Steering Gear House
Drying Room



Profile and Deck Plans of Motor Passenger Liner Aba

comprising a very large sleeping cabin and a sitting room, one furnished in oak and the other in mahogany.

The first class staterooms are all arranged amidships and are divided among the upper and shelter decks, arrangements being made for each to have its own port hole, this applying also to the second class cabins. Most are of the two berthed type but some are single berthed cabins with cot beds. The furniture is of mahogany and each first class cabin has a rug and is of unusually large size with a settee besides the two berths.

The arrangement of the cargo holds is clearly indicated on the drawings but special attention may be drawn to the fact that there are three insulated cargo spaces for the transport of refrigerated cargo. These are in addition to the numerous refrigerating chambers for the food consumed on the ship. 4,000 tons of cargo are carried.

In every respect, the *Aba* is one of the most interesting ships that has ever put to sea, and it is understood that the owners contemplate the construction of still larger motor passenger liners.

The Sun Shipbuilding Company's New Dry Dock

Forty-Two Ships Docked During First Six Months of Operation, Averaging One Vessel Every 3½ Days

The Sun Shipbuilding Company, although but five years old, has already established a record which places it high on the list of efficient shipyards and its advance into the ship repairing field last year has been attended with the same success that has placed it among the leading ship construction yards.

In 1920 the directors of this organization adopted plans for improvements to the plant with a view to broadening its activities to include general ship repair work. The prime requirements necessary to accomplish these results were a dry dock and wet basin of sufficient size to handle the majority of the vessels comprising the world's merchant fleet. A 10,000-ton dry dock, located at the head of a wet basin 960 feet in length with a mean average depth of 40 feet and a width at the river of 385 feet was decided upon as fulfilling the above requirements.

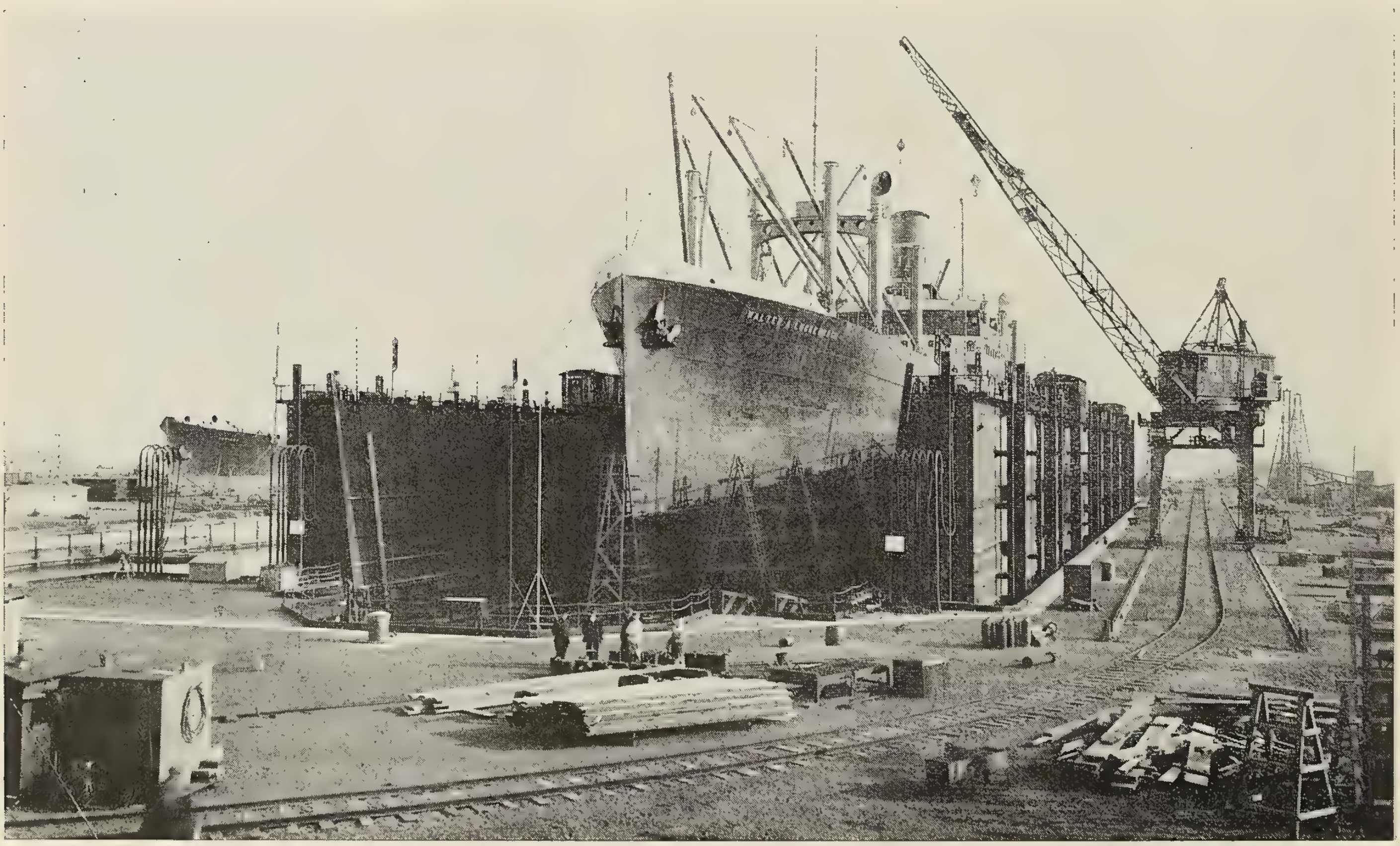
Dredging for the wet basin was started on July 8, 1920, and on December 1, 1920, work was started on the first pontoon for the new dry dock. On June 11, 1921, the new basin and dock were placed in commission and later in the day the first vessel, the Sinclair Navigation Company's tanker *Joseph M. Cudahy,* 10,600 deadweight tons, was docked.

Since then to December 1 no less than 42 vessels have been docked for painting, cleaning or bottom repairs, making an average of one vessel every 3½ days.

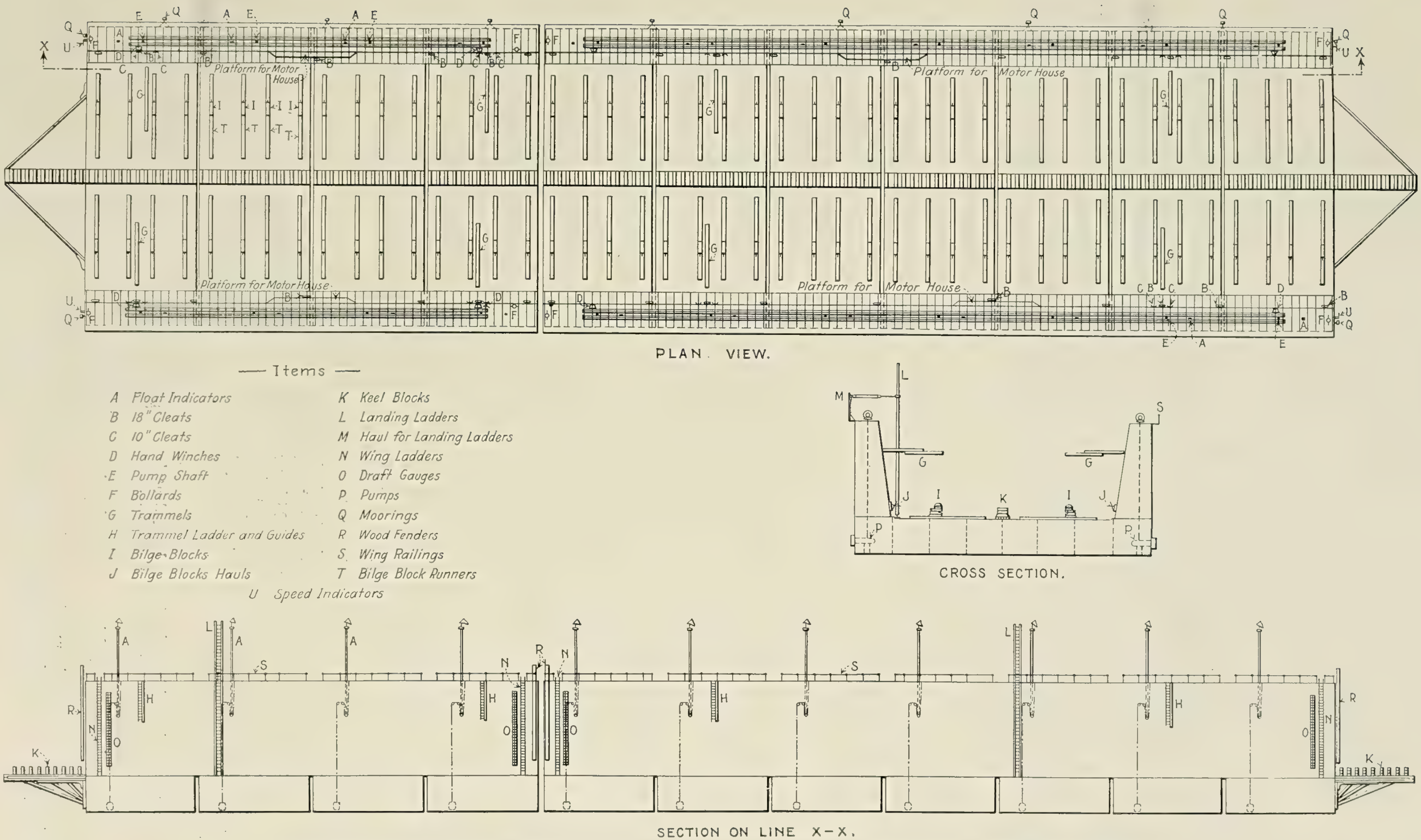
The Dock

The dry dock is of the floating type designed by William T. Donnelly, consulting engineer, 17 Battery Place, New York.

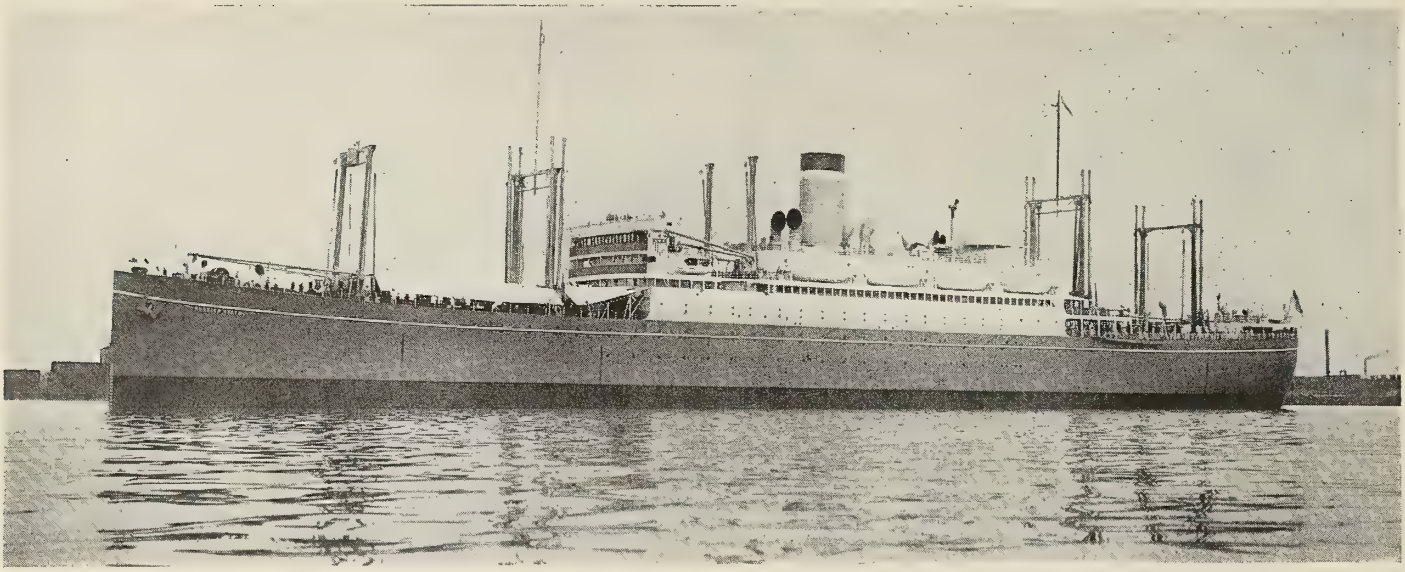
The general design consists of wooden pontoons of heavy spruce timber and continuous steel wings in accordance with the well known Donnelly methods of dry dock construction. An innovation, however, has been incorporated in the Sun dock in that it has been constructed in two sections.



View of Wet Basin at Sun Shipyard, Showing New 10,000-Ton Floating Dry Dock in Operation



General Arrangement of 10,000-Ton Donnelly Floating Dry Dock Built for Sun Shipbuilding Company



Passenger and Cargo Steamer Hoosier State

The first section, made up of 7 pontoons, is 323 feet long over the outrigger and the second section has 4 pontoons and a length of 197 feet over the outrigger.

Each section is a complete dock in itself and may be used independently of the other, the larger section having an actual lifting capacity of 6,400 tons and the smaller a capacity of 3,600 tons.

Sections Can Be Combined

Provision is made for tying the two sections together to form the big dock with a length over keel blocks of 522 feet 6 inches, a width over all of 110 feet and a rated lifting capacity of 10,000 tons. The dock is capable of exceeding this, however, and has an actual maximum lifting capacity of 11,000 tons. This will allow for docking a vessel of a maximum length of 560 feet, breadth of 78 feet and draft of 23 feet.

Each pontoon is 110 feet long, 41 feet wide and 13 feet 5 inches deep.

The wings are of steel construction 13 feet wide at the base and 35 feet high, topped with a working platform 10 feet 6 inches wide extending the full length.

Operation

The dock is operated by electricity.

In the bottom of each pontoon there are two 12-inch centrifugal pumps, one on each side. From each pump a shaft extends to the top of the wing and by means of miter gearing is connected to a shaft running the full length of the wing. This shaft on the top of each wing is geared to a driving motor located in a motor house at the center of the wing.

There are two motors for each section, one on each wing. The pumps in the large section are driven by two 200 horsepower motors and those in the small section by two 125 horsepower motors. Current is supplied from a station on shore and the operation of the dock is controlled from a house on shore designed to permit a clear view for the operator while docking and undocking ships.

Cables are also led from the control house and run on both sides of the wet basin, with outlet boxes located at intervals of 75 feet, from which current for temporary power and welding may be taken.

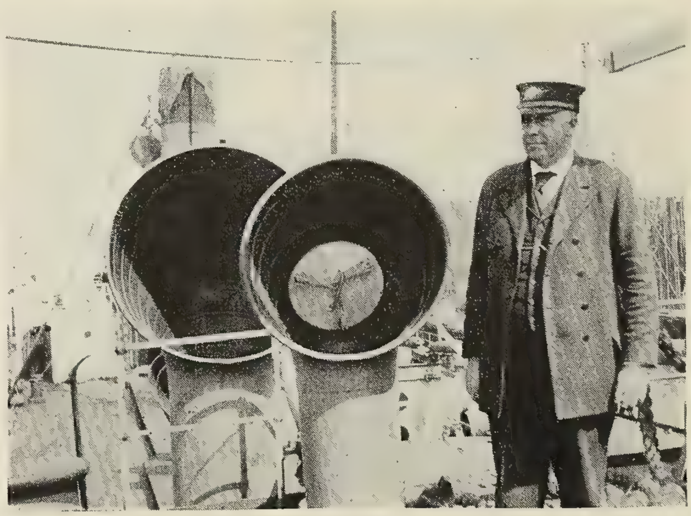
The new Sun dry dock fills a long felt need for such a dock on the Delaware River and the ports of Philadelphia and Chester. It was constructed in six months and eleven days, a record for this size dock and from present indications it bids fair to establish a record for operation as well as construction.

Passenger and Cargo Steamer Hoosier State Delivered to the Pacific Steamship Company

ANOTHER of the 535-foot Shipping Board passenger and cargo vessels has been delivered by the New York Shipbuilding Corporation, Camden, N. J. This is the *Hoosier State* which ran her trials on September 15 and has been assigned to the Pacific Steamship Company for operation. The vessel measures 535 feet overall and has a beam of 72 feet. She is equipped with twin turbines of 12,500 horsepower which will give her a speed of 17½ knots. Accommodations are provided for 280 first class and 194 third class passengers, in addition to a crew of 198 officers and men.

New Type Control for Ships' Ventilators

A RECENT invention for closing and opening ships' ventilators has been perfected and patented by the Ventilator Cap and Cowl Cover Company, Seattle, Wash. It is claimed that but seven seconds is required for capping and plugging one ventilator, and with the services of but one man the full complement of ventilators on an



Ventilator Cap Hanging in Cowl Ready for Instant Adjustment, Closing Vent Water and Air Tight

average size ship can be capped and plugged in fifteen minutes. In conjunction with the steam smothering lines, which are led into the holds for fire protection, the ventilator caps are useful, since the ventilators can be plugged quickly and thus allow the steam to produce a smothering effect almost immediately. Ventilation is necessary in cargo vessels to prevent sweating and damage from other causes, and with the new plug advantage can be taken of all favorable weather because it is possible to close the ventilators quickly at a change of weather.

It is stated that the cost of installation of this capping device while it is of a permanent nature is merely nominal, and the Ventilator Cap and Cowl Cover Company is planning to introduce this equipment through ship repair plants at the more important ports in the country.

Duration Time Watch for Studying Efficiency

For the purpose of facilitating the timing of industrial operations, the Mortimer J. Silberberg Company, 122 South Michigan Avenue, Chicago, Ill., has perfected an instrument designed to handle the timing of from one to ten production motions, up to five minutes in duration.

New Type Time Study Watch

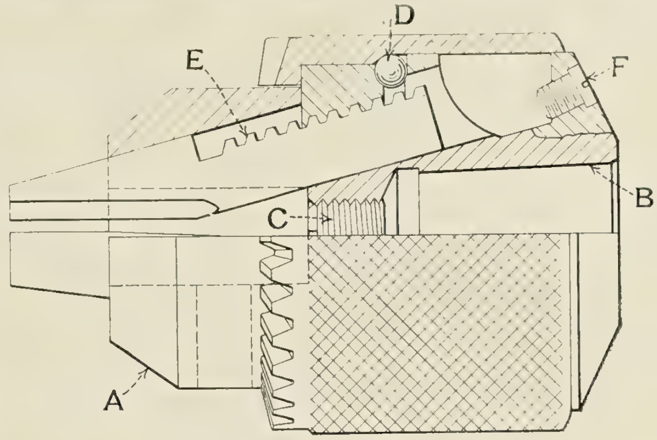
The instrument has three circles on the face of the dial, the outer circle being in red, the center circle in black and the inner circle in blue. The large hand makes a total revolution of 100 seconds, and the small hand in the center moves over a red, black and blue sector, thereby showing in which circle the large hand is operating.

All of the figures on the face of the dial denote production per hour, based on the timing of 10 operations. For example if 10 operations were observed to have elapsed in 20 seconds the figure under the large hand in the red circle would show 1,800 operations per hour, based on 10 operations having been completed in 20 seconds. If instead of 10 operations, one operation is observed to have lasted 20 seconds, then instead of 1,800 it would be necessary to point off one figure with a decimal, and the result would be 180 operations per hour, based on one operation being completed in 20 seconds.

If an operation is timed and its duration is 130 seconds, it will be noted that the large hand will have made one total revolution, and thirty seconds additional, and the small hand in the center of the dial will have passed the first sector, and show in the second sector, which is the black, and which denotes that the operation must be read in the black circle; and reading under the 30-second mark in the black circle the figure 277 will be noted. However, this figure being based on the observation of 10 operations, and only one operation having been timed in that period, it is necessary to point off one figure, and the result is then 27.7 operations per hour, based on one operation timed in 130 seconds.

Toothed Key and Sleeve Type Chuck

THE chuck of the toothed key and sleeve type manufactured for the past eighteen years by the Jacobs Manufacturing Company, Hartford, Conn., has recently been redesigned so that the proportions of the parts now make it more adaptable for general service. The body A is made of steel of a special analysis, deeply case hardened. Through a special process in this heat treating the taper hole B is left soft, fitting it for use on a hardened and ground arbor. This taper hole is ground with great accuracy. A hole is drilled and tapped through the center of the body and fitted with a threaded plug C which may be removed with a screw driver if it is desired to insert rods or other material through the chuck.



Jacobs Toothed Key Type Chuck

The taper hole on the chuck is of the same dimensions as those of previous designs. Each of the new chucks has been designed to meet the changed drilling methods of the last few years with relation to design, weight and capacity, all needless weight having been eliminated.

Ball bearings D inserted between the nut and the body reduce friction to a minimum making it possible to machine the thread E on the nut and the jaws with a coarser pitch than heretofore. Reduction of friction makes it possible to tighten the chuck with great ease, preventing undue wear on the keys, sleeves and other parts of the chuck at the same time giving greater gripping qualities.

An oil hole F inserted in the upper end of the chuck makes it possible to lubricate all of the working parts. One half the pressure on the key in tightening the chuck will produce the same results as in chucks of the previous design and the change in pitch of the thread on the jaws has resulted in reducing by one half the number of turns of the sleeve necessary to tighten or loosen the chuck.

Senate and House Committees Plan Joint Meetings

THE Senate committee on commerce and the House committee on merchant marine and fisheries have planned for a series of joint meetings at which officers of the Shipping Board and of the Emergency Fleet Corporation will be heard. Chairman Lasker has already appeared at one or two such meetings, which are held in executive session, and in a way they are a substitute for the general Congressional investigation of Shipping Board affairs which have been several times proposed.

W. J. Love, vice-president of the Emergency Fleet Corporation, has decided to lay before the Shipping Board for action the practice of steamship companies in the Intercoastal Conference cutting rates below those agreed on in conference.

Design and Construction of Passenger Steamers*

Summary of Problems Confronting the Designer of a Modern Liner — Details of New American Passenger Ships — Standardization

By E. H. Rigg†

THE great problem of today is to design and build ships that can be made economically satisfactory. We are still short of passenger ships; the lack of new orders and holding up of old ones is solely due to economic conditions, high first costs and inability to pay the rates necessarily asked, chiefly the former.

The large number of our recently completed passenger ships which have gone or are about to go into Pacific Ocean trade calls for comment. Of the sixteen 535 footers and the seven 522 footers, representing a gross tonnage of some 300,000, twelve of the larger and three of the smaller have gone into service on the Pacific; of the larger, two are still to be allocated, which indicates that the fleets to which allocations have been made are temporarily satisfied. The Pacific thus gets 67 percent of the tonnage, and there are other indications that our Pacific trade will be large—our interest in China and its development, our nearness to her markets compared with Europe. The Philippine and the Hawaiian Islands make for commerce with the Pacific coast; our Australian and Japanese trade also calls for passenger and freight services.

Then, too, South American trade presents an opportunity awaiting revived foreign trade, improvement in the exchange rate from the foreigners' point of view, improved exporting methods on our part and the working out of the recent foreign trade financial legislation.

Passenger Steamers for Sheltered Waters

Perhaps nowhere in the world are there such opportunities for lake, bay, sound and river navigation as in America. The problems are not as complicated as are those of the ocean; draft is usually limited, and lines adapted for high speed in shoal water are not the same as for deep water. Ports are closer and bunkers carried are lighter; fresh water from overboard is often available for boilers, if not for drinking. Cargo is generally carried in relatively small amounts, largely on deck rather than below. Fire risks are severe in these ships and must be seriously studied and minimized. In rivers and canals, bank erosion must be guarded against, and here the experimental tank has come to our aid in studying wave making. In some recent Hudson river vessels, in particular, wave making has been notably reduced, enabling greater speed to be maintained for the same erosive action or less of such action for equal speed.

Many of these vessels in the past have been built with too little beam for satisfactory stability results; top decks have been increased or added in order to crowd on more passengers, the accident point having been found in more than one instance, notably the *Eastland*, in recent years. Some river steamers have found it necessary to set back the rails, thus limiting the passengers who can crowd top decks; also in boats traversing water with points of interest first on one side, then on the other, water ballast chambers in the wings have been fitted so that the engineer can fill the same on the off side and empty it again after passing the particular point.

Paddle-wheel propulsion still holds its own for this type; the experimental tank is invaluable for correctly locating the wheel center to avoid disaster due to wave profile and wheel not meshing.

Paddle wheels have been recently severely put to it to hold their own with screws working in tunnels as a means of propulsion for shallow draft vessels. We have also seen a revival in proposals made many years ago which looked to the fitting of fixed guide blades abaft the revolving blades to recover some of the energy of the propeller race. It can be said that tunnel screws have definitely established their claims.

Passenger-Refrigerator Trades

The carriage of meat, fruit and dairy products in cold storage has become a very large trade during this generation. Perhaps the chief feature which leads to the passenger-refrigerator ship is the speed desirable for refrigerator ships—the less time on the voyage the better. Also, these cargoes are bulk rather than deadweight cargoes, which means that larger ships are needed for a given weight. Both these considerations lead to the desirability of increasing the revenues by carrying mails and passengers.

There are also some large meat carriers fitted with accommodations for passengers, a valuable revenue being derived therefrom to pay for the speed in excess of 11 knots, about a cargo carrying economical speed limit for vessels of moderate to large dimensions.

Trend of Design; Ocean Passenger Ships

As an indication of this, the following classes of ships designed in part and estimated on, since January, 1918, by one large shipyard in this country, may be of interest:

Length between perpendiculars, feet	Speed, knots	Cabin passengers	Deadweight
400	15	100	4,350
600	18	1,460	15,000
450	23	410	3,700
500	16	250	9,000
550	15¾	1,830	8,650
475	14½	445	5,530
360	13½	50	4,100
450	16	255	6,000
400	15	200	3,900

Several of these ships had third class and steerage passengers in varying numbers. These quarters were portable to a large extent, so only the first and second class quarters and permanent third class cabin accommodations have been listed above, thus giving a better guide to the characteristics of the vessel. In the 600-foot ship, accommodation for 700 third class passengers in permanent cabins is included; also in the 550-foot ship 1,160 such third class are included. The list thus gives the real cabin accommodation, whether first, second or third.

The 23-knot ship was primarily intended for a coastwise run, but also for transpacific, so that she is correctly rated as an ocean-going ship, though whether the full 23 knots would be maintained on a deep sea run is problematic.

The average length works out at 465 feet, a very modest figure for nine typical passenger ship designs, and, omitting the 23-knot ship, the speed averages 15½ knots. It would seem fair to regard the high speed of 23 knots in a 450-foot ship as quite exceptional. It is worth noting that 15½ knots is quite modest for a 465-foot ship and that it checks up with the tendency noted above. These ships are uniformly of the shelter or shade deck types with ample superstructures amidships and generally with forecastles.

*Paper read before the Society of Naval Architects and Marine Engineers, New York, November 18, 1921.

†Naval architect, New York Shipbuilding Corporation, Camden, N. J.

Fully half these inquiries were from foreign owners, an encouraging sign.

Besides the above listed vessels, other inquiries not involving detailed design work were received; they lined up well as to type with those given and do not change the indication of the trend.

As regards proportion, the old and lingering tendency to narrow beam is at last giving way; it is not going fast, but it is yielding to two influences; the old ship that capsizes when handling light in harbor, unless ballasted, evidently is a nuisance and has plagued a good many people. The war has served to emphasize a tendency already to be seen by those on the inside, and that is to give more metacentric height and listen less to the discomfort of passenger talk that was so prevalent. Personally I feel that you have to go to metacentric heights far higher than the prevalent 18 or 24 inches in order to get appreciable discomfort; in other words, get all the data you need by studying stability and rolling features in successful ships, then adopt a G. M. about twice pre-war standards and you will have a ship that is not too stiff.

The other cause leading to more beam is the finding by Admiral Taylor and other investigators working in the experimental model basins, to the effect that more beam can often be given a ship and enough coal saved by fining up (for the same deadweight) to pay for the little extra steel weight generally involved. In other words, the bugaboo of narrow beam is under investigation and is getting to be in a bad way. It must, however, be noted that stability considerations due to the flooding of a damaged ship point to caution in increasing beam. War experience has given us a large volume of data concerning the behavior of flooded and sinking ships, and this, intimately associated with subdivision lessons, will ultimately give us safer all-around ships.

The strength of our position in cargo-carrying tonnage is not yet reflected in the passenger-carrying trade, but with our operators in the passenger trades encouraged by the delivery of new ships and by the reconditioning of captured vessels, the outlook for the future is brighter than it has been for at least two generations. There is also some encouragement for builders in that the void in their yards caused by the prevailing lack of cargo ship orders may be partly filled by orders for passenger ships. It seems safe to forecast that passenger ship construction will figure somewhat prominently in our bigger and best equipped yards during the next few years, particularly when it is remembered that a considerable number of ships now running would, but for the war, have been out of service ere this and that they will need replacement just as soon as practicable.

Bulkhead Subdivision

This subject has been very much to the front since the spring of 1912, when the world was shocked by the disaster which befell the *Titanic*. As the question stands today we have the results of the international convention to work on together with the British Bulkhead Committee's Report, followed up by such papers as those of Abell, Benvenuti, Chamberlain, Denny, Dickie, Donald, Finlay, Foster-King, Gatewood, Hovegaard, Lovett, Orlando, Robb, Wall, Webster, and Welch. We also have governmental and classification society instructions to guide us.

The war has taught us that a spacing of 40 feet is about the minimum desirable to cover war risks, as a closer spacing gives torpedoes a good chance of blowing out two bulkheads at one explosion. Our Pacific coastwise passenger steamers should have more attention in respect to bulkheads. It is proven that good bulkheading will save many a ship altogether; also that the ones it does not finally save it will often keep afloat for hours and thus give full time for rescue work to be made effective.

One-Class Liners

As it has developed since the war, this is a relatively new idea and one which has much to commend it; on a large, high-speed liner the *de luxe* accommodation very naturally and properly occupies the best of the available space. Second class is generally aft and quite limited as to public rooms and promenades. Third class comes in below first, and the forward deck is the airing space, this being frequently so airy that none but ablebodied seamen can navigate with safety.

What better way to solve the problem than to carry the passengers willing to pay the rates on the larger and faster mail steamers and to give the benefit of the best parts of other ships to people willing to pay cabin rates for passage in slower ships, run at lesser operating costs and carrying relatively more freight. The idea works out well in connection with the moderate sized ships built since the war; it gives greater flexibility in operating fleets, taking care of seasonal changes in business conditions.

Another point which should not be lost sight of is that the one-class liner works in well with moderate first cost of ship. The one-class ship, or rather the ship with absent class distinctions, is something that deserves to succeed, and let us hope to see it do so.

Length

In 1912 Mr. J. Foster-King presented some very interesting diagrams to the International Congress of Navigation in Philadelphia. These pre-war indications of the trend are extremely valuable at this time; the diagrams are produced to 1920 and thus enable performance and estimate to be compared. For the largest type of North Atlantic liner, the 1,000-footer was indicated; in the *Aquitania* and *Majestic* (ex-*Bismark*) we find pre-war justification of the forecast. Coming down to the longest types for general first class passenger service and selecting some fourteen of the most noteworthy post-war designs actually launched, we find an average length of 585 feet, the greatest being 650 feet and the smallest 505 feet—five only being 600 feet and over. Mr. King's curves gave 775 feet for Atlantic liners, excluding the leviathans, and 650 feet for general first-class liners; it is clear that the 1912 outlook has not been realized, a point also clearly brought out in several other directions; the fact that the 585-foot average includes several Atlantic liners tends further to show the reduction, the figure with which it should be compared being intermediate between 650 and 775, in a ratio difficult to get at.

It seems reasonable to say that large passenger ships have been shortened by 100 feet from considerations arising out of the war. The chief influence at work is the high cost of ships, which makes it a serious question with owners as to whether they can charge passage rates high enough to realize on their investment without killing the business of passenger carrying by reason of the inability of people in sufficient numbers to pay such rates.

The Thousand-Foot Liner

The long spell of idleness at her dock of the *Leviathan*, after invaluable troop service, is rather a damper on 1,000-foot ardor; nevertheless, it remains a fact that a vessel of this length was well in sight when the war broke out. At least one design has been seriously started and pushed to the point of a study of schedules, terminals and rail facilities,

of a full set of outline plans, of extensive calculations and of detailed lay-out out of proposed propelling machinery.

This design contemplated going to Panama Canal lock limiting sizes at one step; it is not necessary to say that the two ships would run between New York and London, starting and arriving at deep-water harbors at each end and with rail connections to New York and London.

It can be safely said that the engineering features, especially when high tensile steel is used, present no difficulties which cannot be met. The problem is one of economics entirely. Is the route able to support such liners without government aid in some form? If not, what justification can be advanced for claiming such aid?

We can, as shipbuilders and engineers, say that, as far as our profession is concerned, we stand ready to furnish the ship and her propelling machinery just as soon as other considerations justify such a vessel. As a matter of record and interest a few particulars of the design as it stood in its earlier stages may be of interest:

Length, over all	1,000 feet
Breadth	105 feet
Depth	76 feet
Deep load draft	38 feet
Speed at sea, knots (depending on weather)	30 to 32
Shaft horsepower (maximum)	150,000
First class passengers	1,100
Second class passengers	800
Third class passengers	1,400

The propelling machinery at first contemplated was electric drive; with the large battle cruiser *Hood* at sea, the path has been opened to the full consideration of the claims of a geared turbine drive.

The oil fuel required for a round trip is in the region of 11,000 tons. This would be too much for the ship to leave this side with; the answer would be to leave here with oil for the trip over and halfway back, taking in oil for the other half of the returning voyage on the other side before leaving. At full load this vessel would have a total deadweight of about 12,000 tons. There would be no freight as is generally understood; mail, bullion and express matter, yes; also such small consignments of special freight that could be handled during the time necessary to refuel and reprovision the ship at each end.

In the early days, when this length was first proposed, the scoffers, technical and otherwise, were legion. Not so now; technical scoffers at once merely proclaim their ignorance. On the financial side there is ample room for hesitation and there the matter must rest for a while, to be taken up again as the world recovers from the effects of the war.

Depth and Draft

This subject is one calling for special mention. It can be stated at once that the drafts adopted for large liners are not those that the naval architect would choose, if he had a free hand; neither are they the ones dictated by considerations of the limitations of steel as a shipbuilding material. Terminal harbors and canals are the main deciding factors. Suffice it to say that the economics of the ship can benefit by increased draft up to the point where such increase imposes excess costs on harbor authorities, which would have to be passed back to the ship in the form of increased and excessive harbor charges.

A really first-class harbor should nowadays have a depth of at least 40 feet, and Lord Pirrie advocates 45 feet; with such depths and corresponding drafts of about 37 feet 6 inches to 42 feet 6 inches economics of transport are available. Mr. J. F. King's forecast in 1912 is worth noting; his figures gave a 1920 draft of 36 feet 6 inches for Atlantic liners and for average passenger ships. The predicted Suez Canal depth of 30 feet came very close to being a mean draft for such ships, which showed steady increase up to a 25 to 34-foot range. Draft increases relatively and actually more slowly than length, it is hardly necessary to say.

The Panama and Suez canals are bound to exercise a profound influence on the drafts of passenger liners, the figures for which now stand as follows:

1. *Panama.*—A minimum depth of 40 feet in the canal, with 40 feet in the Atlantic and 35 feet in the Pacific approaches at mean low water, which means an available draft of about 38 feet.

2. *Suez.*—At present the available depth is 32 feet and permissible draft is 30 feet; the authorities are dredging for 34 feet 6 inches and 31 feet figures respectively.

It is to be noted that Suez has gradually been deepened by dredging from 19 feet in 1870 to 32 feet in 1920.

Liners of the future will probably not be able to avail themselves of all the draft economically desirable, for we are now approaching the region of excessive dredging costs in certain harbors.

Another big factor in restricting draft is the River Plate; many vessels now trading there on a 26 feet 6 inches limit could well have been designed for 30 feet.

Speed and Power

Looking back on the not so distant days when it was necessary to plead the advantages of experimental tank work, it is gratifying to reflect on the conditions of today. In addition to resistance and estimated horsepower curves, the experimental work now being done on model propellers, both in free water and behind ship models, calls for commendation. This is a field that has been opened up comparatively recently.

In addition to deep water conditions, attention is given to shoal water problems, so important in connection with inland navigation. It is known that lines suitable for deep water are not necessarily good for shoal water.

Coming to passenger liner speeds, before the war we had reached 26 knots for all the way across the Atlantic, this in the *Lusitania* and *Mauretania*. In the later Cunarder *Aquitania* we see a reduction to 23 knots, while the large White Star boats ran in the neighborhood of 21. About the maximum for the long routes to the Cape, India and Australia was 18 knots.

Moderate speed will be a feature of new construction for a while. The average speed for fourteen post-war designs for all trades is about 16½ knots with a range of from 14 to 18 knots. New ships on the North Atlantic average up well with those on the general routes of world travel, instead of the accustomed 21 to 23 knots of the old days. In the attainment of better results, the competition in systems of propulsion does, and will to a greater extent, contribute to a lower consumption of fuel per horsepower. The problem is threefold—lower resistance, better wheels and more economical power plants.

Speed has an effect on design that is not clear at first glance. The piling up of deck houses is a noteworthy feature of many modern vessels. High deck houses are one solution of the ventilation question that cannot be ignored, for we all like an airy room.

The claims of the watertube boiler over the Scotch for high-speed ships have made good to such an extent that they will feature more largely in future ships.

The Cost of High Speed

Apart from the initial cost of the machinery necessary to obtain high speed, the fuel bills become very high. For example, consider a 750-foot Atlantic liner of varying speeds from 15 up to 30 knots; such a ship would have a beam of about 90 feet and a deep draft of 36 feet. Call the voyage 3,000 miles, which gives a round figure close enough for our purpose. Remember, too, that as speed goes up cargo carrying ability goes down and passengers, mail and express mat-

ter become ultimately the sole sources of revenue, outside subsidy. The figures are about as follows:

Speed at Sea (Knots)	S. H. P.	Total Dead-weight	Cargo Dead-weight	Oil Fuel, One Way (Tons)	Cost of Fuel, One Way
15	16,000	29,000	26,500	1,450	$26,100
20	38,000	23,000	19,400	2,550	$45,900
25	73,000	14,000	9,000	3,900	$70,200
30	113,000	5,800	.....	5,000	$90,000

Such a vessel would carry some 600 first, 450 second and 1,000 third class passengers and would be quite big enough for speeds all the way to 30 knots. It is seen that the 30-knot ship carries nothing but passengers, mails, stores and bunkers, which is the logical outcome of this investigation. The above table will show that, with cargo capacity falling from 26,500 tons to nothing and fuel costs rising from $26,100 per voyage to $90,000, the economics of the large ship are not easy. It is clear, however, that the greater number of voyages per year for the 30-knot ship must also be taken into account. This may be summarized somewhat as follows:

Speed of Ship (Knots)	Days at Sea, One Way	Days in Port, at Each End	Days for Single Trip	Single Trips Per Year	Passengers Per Year, at 85 Percent Full	Cargo (Tons) Per Year
15	8 1/3	9	17 1/3	17.3	30,270	3,897,000
20	6 1/4	7	13 1/4	22.6	39,550	3,726,500
25	5	5	10	30	52,500	229,500
30	4 1/6	3	7 1/6	42	73,500	....

The compensations coming to the fast boat show up in this table; she will carry more than twice the people per year at, naturally, much higher rates per person. It is also clear that the 15-knot ship does not deliver enough extra freight to compensate for the fewer and lower rate passengers carried. With everything lined up properly, the 30 knotter will make twenty-one round trips in a 300-day working year, *i. e.*, a round trip every two weeks. Two such ships, laying off during the two bad months to avoid the worst weather, could command the cream of the travel.

They are not excessive in size, and even if they only make twenty round trips per year, due to miscellaneous bad weather and sometimes taking the longer southern route to clear ice and fog, such ships equipped for first and second cabin only would each average 45,000 passengers per year, which at, say, $250 per person comes out at $11,250,000 against a fuel bill of $3,800,000, which is not so hopeless. May I commend this 750 footer as a step well worth considering in our further progress towards the solution of the problem of the modern Atlantic liner?

Another interesting angle to the speed question is that of increasing speed in vessels of moderate dimensions. A maximum speed-length ratio of unity has been a general guidance rule for ocean passenger ships for many years. With lighter machinery, oil fuel and other advances, the speed question again becomes one for renewed study and discussion.

The following table shows the fuel savings possible for high speed, moderate dimensioned vessels:

Length of ship (feet)	S. H. P. at 25 knots	S. H. P. at 30 knots
600	56,000	137,000
700	64,000	119,000
800	68,000	131,000
900	80,500	153,000
1,000	91,000	163,000

These figures represent smooth-water powers plus 10 percent for the 25 knotters and plus 15 percent for the 30 knotters. The dimensions dependent on length follow average merchant practice, except that the beam on the 1,000 footer has been limited to suit the Panama Canal lock dimensions to 102 feet.

Destroyers attain a speed-length ratio of 2.00, but it cannot be claimed that they attain it with comfort and safety except in quite moderate weather. European cross-channel steamers obtain a ratio of 1.50 with greater safety and comfort than destroyers; where the line must be drawn for the North Atlantic is our problem. The ships listed above cover a range of from 1.225 for the 600 footer to 0.95 for the 1,000 footer at 30 knots. The *Mauretania's* figure is 0.95. From this it is submitted that the 750-foot ship of 30 knots as proposed above is practicable, providing the fore ends of the ship and of the midship deck erections are especially designed and strengthened, with a view to avoiding deck damage in weather not otherwise severe enough to make slowing up necessary. All fittings and deck openings before the bridge would need to be of special design.

The question of powers to be expected, if very fast liners of warship types were to be adopted, is interesting and is another angle of the question that should be investigated. The proportions and speed both render large and high deck houses out of the question; the passage would be short and promenades would have to be arranged on the quarter deck aft and on one deck amidships well protected from spray. Fast yachts have already been built on destroyer lines, so that liners on cruiser lines are only a logical step and one that has been discussed before. The speed has been taken at a 20 percent advance on previous general practice; the time on a 3,000-mile run in moderate weather is also given. In the powers given a 10 percent margin for sea speed is allowed over a measured mile performance. The bunkers work out at quite large figures. It can be assumed that oil fuel is obligatory, coal handling would be well-nigh impossible both on board and alongside. These bunker capacities are high, but not impractical. Taking only first class passengers and allowing 1½ per foot of length, we get the numbers given in the table. The longitudinal coefficient is 0.58 and the mid area 0.90 for all lengths. It is seen that the increase from 29 to 36½ knots cuts one day off the voyage.

As regards weights, it is clear that warship practice rather than merchant would have to be followed for machinery design; the absence of armor, torpedo protection; battery and ammunition weights being utilized on deck erections, passenger accommodations and bunkers.

Mean displacement	10,000	20,000	30,000	40,000
Full displacement	11,500	22,750	33,850	45,000
Length, feet	585	735	850	930
Breadth	58.5	73.5	85	93
Mean draft	19.5	24.5	28	31
Mean speed, knots.....	29	32½	35	36½
Total E. H. P.........	27,500	61,000	97,250	135,000
Total S. H. P.........	50,000	112,500	177,500	247,500
Oil for 3,000 miles.....	2,300	4,700	6,800	9,100
Days on voyage	4.31	3.85	3.57	3.42
Passengers	875	1,100	1,275	1,400

The Beginnings of Our Postwar Passenger Fleet

During the war our dependence on allied troop transports led to the ordering of some twenty odd large and some thirty odd moderate sized transports at Newport News, Bethlehem, New York Shipbuilding Corporation and Hog Island. None of these vessels was completed prior to the armistice, and some were subsequently cancelled, mainly the smaller ones at Hog Island. These ships are now in service, some as troopers (Hog Island) and some as passenger liners, with the latter of which only are we here concerned. Of the larger ships, Newport News built two, Bethlehem five, and New York Shipbuilding Corporation nine, a total of sixteen ships of some 225,600 gross tons; the smaller ships number seven, all built by the New York Shipbuilding Corporation, totaling some 73,800 tons gross.

Their outline particulars are as follows:

Item	Old North State class	American Legion class
Length, overall	522′ 8″	535′ 2″
Beam, molded	62′ 0″	72′ 0″
Depth, molded	42′ 0″	50′ 0″
Load draft	32′ 3″	30′ 7″
Corresponding deadweight.	13,000	11,400

Item	Old North State Class	American Legion Class
Sea speed, knots	14	17½
Shaft horsepower	.....	12,000
Indicated horsepower	6,500	.....
Boilers (oil fuel)	Scotch.	Watertube.
Motive power	Reciprocating engines.	Geared turbines.
First class passengers	78	260
*Third class passengers	.....	300
Gross tonnage	10,540	14,100
Crew	117	134
Bulkheads	11	13

A few words on the outstanding characteristics of these ships may be in order:

1. *Passenger accommodation.*—This is unusually spacious. Large rooms, beds rather than bunks, numerous private bathrooms, and ample public rooms are noticeable, especially in the larger vessels. Running hot and cold water is supplied in the rooms.
2. *Cargo handling.*—Both in the number of hatches and in the facilities at each hatch, this feature is especially well cared for, quick turn around being thus possible.
3. *Unusually close subdivision.*—Being laid down as three-compartment ships for troop service in the war zone, these vessels are all very well bulkheaded, especially the larger ones, where cargo is not so important.
4. The interior decoration has received greater care than usual, our colonial period supplying the dominating scheme of architectural effect. This has been modified in certain spaces, such as the verandas, tea rooms and smoking rooms. Furniture, decorations and draperies were from designs by W. & J. Sloane of New York. The architectural plans for the larger ships were mainly by the Bethlehem Shipbuilding Corporation and for the smaller ships entirely by the New York Shipbuilding Corporation.
5. Unusually large steaming radius to enable Pacific Ocean and South American trades to be adequately negotiated.
6. The similarity of bow and stern is unpleasantly noticeable, this being an inheritance from war days.

Interior Decoration

The first requisite from the point of view of the passenger, after that of the general good or bad repute in which the line and ship he sails on is held, is that the general arrangement of the accommodations shall be such as to contribute to his comfort—enough promenade space and open decks for games, ample ventilation at all times and heat in winter, well-arranged staterooms and public rooms, access to all parts under cover. An essential factor in all this is the interior decoration. As in Pullman cars, so in ships, we have happily gotten away far from the days of heavily applied ornamentation. In ships it has been realized more and more that good interior architecture and decoration do not necessarily involve additional expense, or rather expense beyond an immediately appreciable return in the enhanced reputation of the vessel in question in attracting passengers.

Of the later periods which lend themselves to ship decorative architecture the Tudor and Flemish are found most frequently in smoking rooms; the periods of Louis XIV, XV and XVI of France in the music rooms, lounges and galleries. From classic and Gothic in lesser amounts we pass on to a wealth of the Renaissance of Italy and of France, to the English and Dutch evolutions and lastly to our own Colonial, the keynote to the decoration of our postwar ships of the *American Legion* class.

We have heard lately of ships that were overdone in the lavishness of their appointments. Let ships be designed each for their own trade, with due consideration to climates passed through, to the likes and dislikes of the people carried, to the length of voyage. A rational answer to these questions will settle both the decorative and elaborateness questions.

*Two of the smaller ships are being fitted for third class in the top 'tween decks.

Extent of Arrangement of Public Rooms

The arrangement which works out best in ocean going ships gives dining rooms on the lowest passenger deck with galleys and pantries around the casings and extending full width, the other public rooms being arranged on the top deck, opening one from the other and with wide passages or galleries between, enabling the best all-round result to be obtained. A dome over the dining saloon with exhaust fans is a most important contribution to comfort, coolness, lighting and decoration.

In the larger steamers the old-time narrow passage is giving place to the gallery between public rooms. This feature enlarges the scope of the living quarters, provides library, reading and writing facilities, besides giving ample communication under cover for use during the evening or during bad weather.

Promenades

Many ships sacrifice this feature to piling in the maximum possible number of staterooms, obviously to increase revenue. The liner, to be popular, must have good open decks for lounge chairs, walking and games, with decks adapted for outdoor sleeping on tropical runs.

Outside Rooms

In smaller ships all rooms can and should be outside rooms, *i. e.,* with ports or windows opening direct to the outside air. As ships get bigger our difficulties increase; the "Bibby" room is the popular solution, the inside room having a narrow passage leading past the outside room to a port. For vessels navigating sheltered waters the transverse berth greatly helps the designer of good passenger accommodations, but for sea going ships, the fore and aft berth, with only occasional exceptions, is the rule.

Single-berth Rooms

No doubt this is a feature appealing to all people traveling alone. A most ingenious plan that can be used in all vessels, particularly in those with ample 'tween-deck height, is that of placing two berths over each other, but so stepping the dividing bulkhead that one berth is in one room and the other in another room; in one room there is a lower berth only and in the other an upper berth only.

Details of Construction

Standard transverse framing continues to be the general rule for passenger ships. Wide-spaced framing is often adopted in order to get a spacing that suits details of accommodation better. If pushed to extremes, framing too deep for good hold capacities may result, besides very heavy shell plating: in way of machinery, deep framing does not affect capacity; carefully applied, it can be made an advantage. Longitudinal framing has not the same strong hold as in oil tankers and in long shallow vessels of all classes; vessels for rivers, etc., will always do well to consider longitudinal framing, but for deep-sea passenger vessels, with many decks, its advantages are not so clear.

Cruiser sterns for twin (and above) screw ship have solid merit in improving stability and speed performances. For single screw ships they are generally a bit of a misfit.

Electric arc welding has found a definite place in shipyards and there is ample room for a welding department in any big yard to work on details.

Wooden decks inside quarters are well nigh a thing of the past in ocean ships; there are several satisfactory plastic deck coverings for all interior spaces other than those generally cemented and tiled. There are also several forms of cork flooring which give good results. Parquet may be desirable for inside dancing spaces. Wooden decks are still premier for open deck spaces over quarters and for promenades.

In order to shorten turn around in port, either ship or dock, and sometimes both, have to be better equipped with cargo gear than was only a short time ago considered proper. The *Old North State* and *American Legion* classes fully bear this out, their twin derrick systems and numerous hatches having been commented on in every port visited. It should be noted that their close subdivision accentuates this feature.

The recent revisions of the rules of all the classification societies have placed in the hands of the shipyards methods of designing structure and details which enable much quicker and better work to be done.

Joiner work is not so dependent on wood for panels as formerly; as with sanitary floors, so with paneling, there are now on the market several satisfactory composition boards, and panels of these, mounted directly on the tongue and groove partitions, enable the two sides of a bulkhead to be fashioned to suit the furniture to much better advantage than with ordinary panels.

Lighting, heating and ventilation have improved of late; steam heat is largely replaced by electric radiators, which are particularly adapted for individual room heating in association with a thermo-tank system raising all the air to about 60 degrees, leaving the balance required to electric radiators.

With oil fuel, piping problems become more complex; the air escapes from the amidship tanks are sometimes difficult to handle in way of passenger spaces, an excessive possible head on the tanks being only avoided by taking them out through the shell. Oil fuel galley ranges are also a modern touch in oil-burning ships.

Communication and indicating devices get more complicated, fire-alarm systems, pneumercators, gyro-compass systems and submarine bell listening devices are among the newer modern tendencies.

Better bulkhead subdivision has helped fire protection; with alternates carried up to the top decks, modern ships have been afforded a much better chance of confining and subduing a fire.

The extra boatage now fitted on passenger ships has given trouble. Better bulkheads argue for less boats, though "boats for all" is rightly the generally recognized minimum acceptable. The writer feels that more rafts might well be allowed, especially where bulkheads are good.

Compulsory air ports on the lowest passenger deck might well be reconsidered.

The extent to which oil has been substituted for coal as a fuel calls for comment. Lloyd's returns indicate that 22½ percent of the world's total gross tonnage uses oil for propulsion, as compared with 3 percent in 1914, a stupendous increase and one that is mainly in vessels of American registry.

Standardization

The British Engineering Standards Association has revised its rolled steel section standards, inviting us to cooperate. Some work has been done here along those lines and this society, with others, has appointed committees to act in conjunction with the American Engineering Standards Committee. As a result of the war we are in much better shape than formerly as regards the obtaining of a wider range of steel sections suitable for shipbuilding and are not without hope of being in better shape yet, once the revival of business brings the exporters to realize the benefits of standardization.

The British have gone further and are at work standardizing ship fittings as far as found practical and desirable; this is a far-seeing step in the maintenance of their shipbuilding position and one we should not lose sight of.

The work done in the standardization of marine oil engine construction has been fully covered recently in publications devoted to the internal-combustion engine.

Considerable progress has also been made abroad in standardizing steam marine reciprocating engine and Scotch boiler construction as far as moderate and low powers are concerned. This is advantageous in more ways than one. It facilitates construction and, equally important, it facilitates upkeep.

Anything which helps standardization along rational lines should have our united support. The claims for the prompt execution of repairs is one that should not be overlooked it is an aspect of standardization that deserves more attention than it has received, though it is largely taken care of by standardized construction.

Competition and the Future

As an indication of the need that exists for passenger ships, the following table is of interest:

World's Sea-going Tonnage

	1914 Gross tons	1920 Gross tons
Liners and intermediate vessels........	13,345,000	12,107,000
Cargo ships	24,935,000	32,518,000
Tankers	1,479,000	2,934,000
Totals	39,759,000	47,559,000

The lines of tied-up cargo ships are well explained by the above figures. The shortage in ocean passenger ships is brought out, also the wisdom of the Government in deciding to finish the main program of wartime transports later converted to passenger ships. In using the word shortage, care must be exercised to discriminate between present and normal times.

Indications are not lacking that our Pacific and South American trades are soon going to become well developed. On the North Atlantic we are not as yet adequately represented. The Pacific has given one sign of renewed progress in the *Empress of Canada*. She is almost as much a step in advance over Pacific Ocean average as the *Mauretania* was on the Atlantic. Our new liners will not long occupy any leading place among noteworthy ships, so that our hold on the trade will before long demand larger and faster vessels.

The laying down of a 30,000-ton passenger ship by Harland and Wolff for the Holland-America Line is reported, this being the largest vessel commenced in Britain since the war. The end of the retrogression in size appears to be in sight.

Shipping Board Authorizes Sale of Twenty Vessels for Conversion Into Motorships

ADMIRAL W. S. BENSON, commissioner of the United States Shipping Board in charge of construction and machinery efficiency, has announced that the Shipping Board has determined to offer for sale 20 of its vessels to purchasers who will agree under bond, or other satisfactory guarantee, to the installation of full Diesel propelling machinery in such vessels. At present day costs, this installation in a 10,000-ton vessel will amount to around one-half million dollars. Sales of Diesel tonnage have been made abroad as low as $60 but the going rate today is probably nearer $80. The Board is prepared to sell for cash the above tonnage to the highest bidder who guarantees immediate installation of types of machinery to be approved by the Board on such a basis as to make this offer an attractive one.

It is the unanimous opinion of the Shipping Board that in this action it is carrying out three important provisions of the Merchant Marine Act: first, placing of its tonnage in private hands; second, providing the most modern type of vessel for service under the American flag, and, third, giving work to American shipyards at a time when their business is at very low ebb.

Instability

Conditions That May Lead to Instability and the Consequences That May Be Looked For

By C. H. Peabody, Dr. Eng.

IN the design of a ship much attention is given to stability, to ensure that the ship shall have enough and not too much stability in all conditions of service and even though subject to injury. It may be interesting to consider conditions that may lead to instability and what the consequences may be.

Our subject involves a negation and consequently is best approached by considering what is meant by stability and how it is secured.

Fig. 1 gives the ordinary representation of stability; a ship inclined to the angle θ has the center of buoyancy B at which

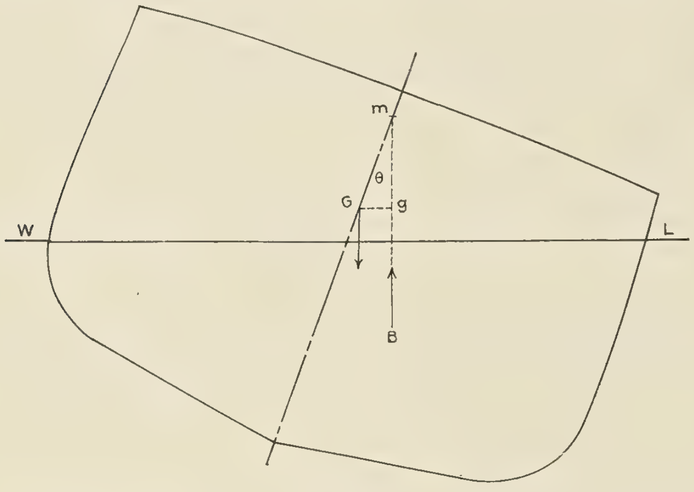


Fig. 1

the buoyant force is applied, the load or weight acting at G, the center of gravity. There is a righting couple

$$D \times G g \tag{1a}$$

when D is the displacement of the ship in tons and Gg is the arm in feet. This expression is known as the stability. By

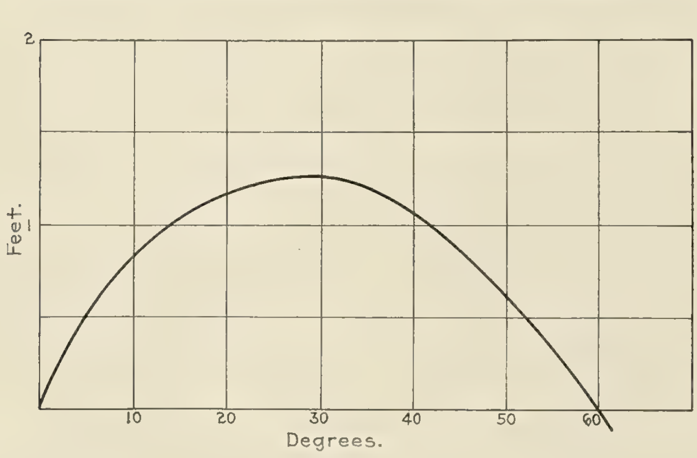


Fig. 2

methods in common use and especially with the aid of integrating instruments the arm Gg may readily be found for any angle and the diagram in Fig. 2 may be drawn which shows the righting arm for all angles up to that at which the stability disappears. The diagram is proper for a steamer which may have a maximum righting arm of 1¼ feet and a range of 60 degrees. A sailing ship will have a higher and longer diagram of stability, the range extending beyond 90 degrees.

Another, and in some ways simpler, method of dealing with stability and conditions leading to instability is by aid of the metacentric height. In Fig. 1 note that the vertical through the center of buoyancy B intersects the medial line through G at the point m; this point varies with the angle of inclination and when that angle diminishes it tends toward a definite point known as the metacenter.

Location of Metacenter

The location of the metacenter is easily determined for a special case as shown in Fig. 3. Suppose we have a floating

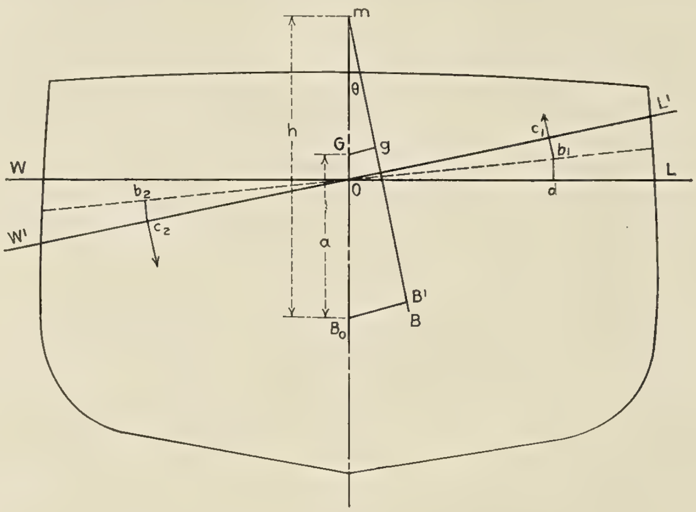


Fig. 3

body (it can hardly be called a ship) that is not only wall sided but is also square ended so that the section shown runs from end to end, or from bow to stern. The immersed volume will be found by multiplying the area below the waterline WL by the length. When the ship is inclined the new waterline $W' L'$ will pass through the midpoint O; a wedge having the area LOL' will be added and a wedge with the area WOW' will be subtracted. The center of buoyancy will go from B_0 to B moving parallel to the waterline the distance BB'.

Now the shift B_0B' is produced by cutting off the wedge WOW' and moving it over to LOL', so that the center b_2 is moved to b_1, that is through the distance c_1c_2. If the volume of the immersed body is V and that of the wedge is v, then

$$V \times B_0B' = v \times c_1c_2$$

$$B_0B' = \frac{v}{V} c_1 c_2 \tag{1}$$

For the crude figure we have chosen for our floating body, or ship, all the quantities on the right hand are easily found. Thus b_1 is on the dotted line bisecting the angle LOL' and at two-thirds of the length of that line from O; but b_1c_1 is drawn perpendicular to OL' and we may draw b_1d perpendicular to OL, whereupon it is easy to see that

$$Oc_1 = Od = \frac{2}{3} OL = \frac{1}{3} B$$

where B is the beam of the ship. Finally

$$c_1c_2 = \frac{2}{3} B.$$

As for the triangular section of the wedge added, its altitude is ½ B tan θ so that its area is

$$\tfrac{1}{2} \times \tfrac{1}{2} B \tan\theta \times \tfrac{1}{2} B = \tfrac{1}{8} B^2 \tan\theta$$

and thus the volume of the wedge is

$$V = \tfrac{1}{8} LB^2 \tan\theta$$

Finally substituting in equation (1) we have

$$B_0B' = 2/3\ B \times \frac{\tfrac{1}{8} LB^2 \tan\theta}{V}$$

$$= \frac{1/12\ LB^3 \tan\theta}{V}$$

$$= \frac{1}{V} I \tan\theta.$$

The letter I is substituted for $1/12\ LB^3$ because it is the moment of inertia of the rectangular waterline of our square ended ship having a length L and a beam B. Any figure has its own moment of inertia which can be computed or

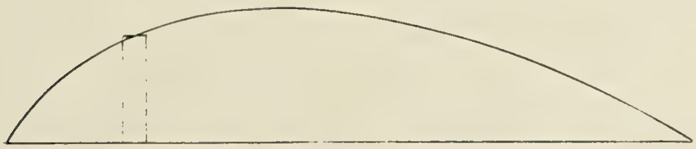


Fig. 4

measured with an integrator. Thus a figure like Fig. 4 may be divided into foot lengths for which the moment of inertia can be computed and then we may sum up for the whole figure.

Like many other things, the moment of inertia sounds worse than it is. It is rather unfortunate as a name because it is long and sounds as though it meant something mysterious. As a matter of fact it means just what it represents, that is

$$I = 1/12\ LB^3$$

for a rectangular figure and something of the same sort for any other figure. We shall later point out its importance for the understanding of stability.

Returning to Fig. 3, let us represent the distance from B_0 to m by h and the distance from G by a. First we may see that

$$B_0B^1 = h \sin\theta = \frac{I}{V} \tan\theta$$

so that

$$h = \frac{I}{V} \frac{1}{\cos\theta} \qquad (2)$$

It is evident that the value of h decreases with the angle θ and that as θ approaches zero h approaches the limit

$$r = \frac{I}{V} \qquad (3)$$

replacing r for h at the limit. This brings us to the consideration of the standard Fig. 5 where B is the center of buoyancy, G is the center of gravity and M is the metacenter; the last name is that given to the limit of the position of m when the ship comes to the erect position.

Returning to equation (1a) and referring at the same time to Fig. 3 we see that the expression for stability may be written

$$D \times Gg = D\ (h - a) \sin\theta$$

For small angles we may replace h by r so that the expression for stability becomes

$$D\ (r - a) \sin\theta \qquad (4)$$

The distance of the metacenter above the center of gravity

$$r - a$$

is known as the metacentric height.

Position of Center of Gravity

This equation gives satisfactory results for angles less than 15 degrees and is a fair approximation to larger angles. Let us repeat that D is the displacement of the ship in tons, r is the distance from the center of buoyancy to the metacenter, and a is the distance from the center of buoyancy to the center of gravity; while θ is the angle of inclination. Of these D and r can be computed with sufficient precision from the lines of the ship, but a which locates the center of gravity is rather difficult to determine in practice.

The location of the center of gravity of a ship depends on the vessel's purpose, construction and loading and is likely to vary widely under different conditions; this is a matter that should be thoroughly discussed by the naval architect and of which the master of the ship should have a good working knowledge. The location of the metacenter can usually be controlled by the naval architect. Consider that

$$r = \frac{I}{V} \qquad (5)$$

and $\qquad I = 1/12\ LB^3;$

by small variations in B, which enters as the cube, the value of r can be given almost any desired value. Again we should have in mind that the metacentric height

$$r - a$$

is likely to vary only from ½ to 4½ feet while r is likely to be from 10 to 40 feet.

Instability, that is the lack of stability, may be a matter of indifference, it may be an annoyance or it may be calamitous; a few examples will be noted.

Steadiness of Ship Not Due to Stability

Contrary to a common idea, stability does not make a ship steady; on the contrary it makes a ship respond readily to

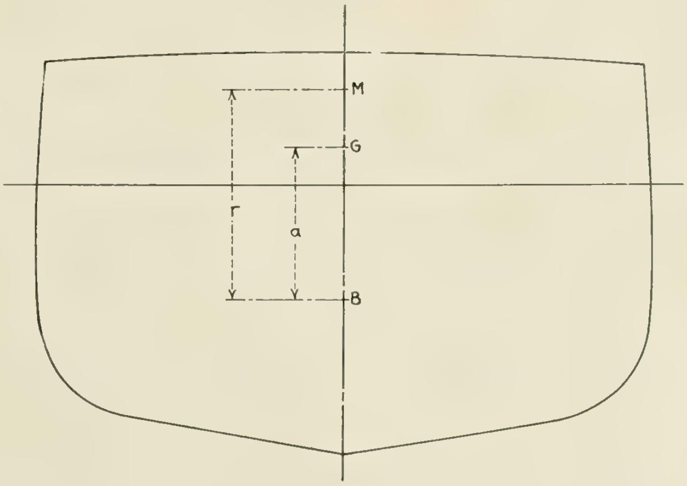


Fig. 5

the influence of the sea so that a stable or stiff ship is likely to roll badly. On high sided passenger ships steadiness is sought by giving a small metacentric height; some passenger ships for the Mediterranean Sea have been given a metacentric height of only six inches. Any ship which is designed for a small metacentric height is liable to lose its initial stability and become unstable. Such a condition will be indicated by a diagram like Fig. 6; when erect, the center of gravity is above the metacenter and the ship is unstable; it will lop over to one side to the angle where the curve crosses the axis, in this case to 10 degrees; if the ship is in a sea-

way it is likely to roll about with a tendency to lean on one side till a wave comes along that throws it over to the other side, and then it will roll about in its new condition. So long as the ship is intact and port holes or other openings are properly closed, nothing untoward will happen. Such a condition is not assuring to the passengers and is not really desirable.

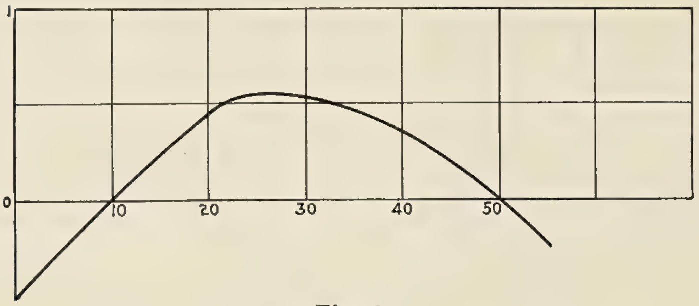


Fig. 6

Effect of Moving or Adding Weights

Before going further let us consider the effect of moving weights aboard a ship or of adding weights. Suppose the weight W_1 in Fig. 7 is raised from the hold to the deck; draw the line W_1G and divide it externally at G_0 so that

$$D - W : W :: GW_1 : GG_0$$

Then from G_0 draw a line to W_2; it will cut the line GM at the new center of gravity G_1; the new metacentric height will be G_1M. Should the new center of gravity rise above the metacenter M, a condition of instability will arise.

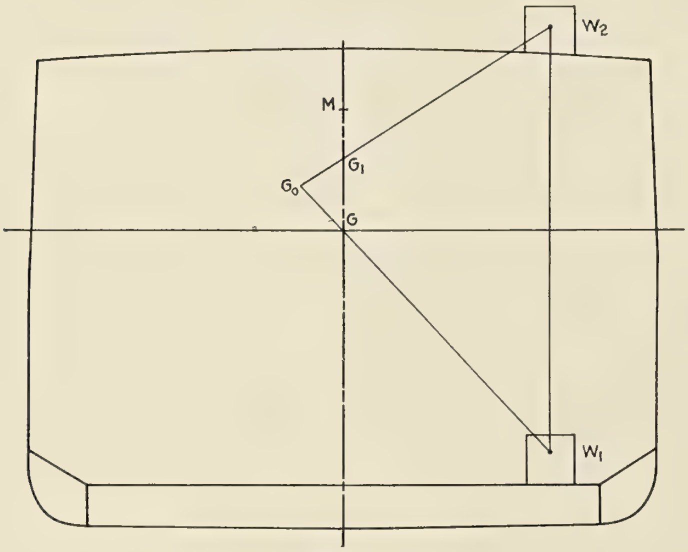


Fig. 7

It is evident at once from the figure that

$$D : W :: W_1 W_2 : GG_1$$

so that

$$GG_1 = (W_1 W_2) \frac{W}{D} \qquad (6)$$

and this equation applies for all conditions, including that with the weight W directly under G. This equation is worked out to get a clear idea of the effect of moving a weight; it may be sufficient to say that the effect is proportional to the weight and to the distance it is moved.

Addition of a weight and its effect on stability is likely to become a bit complicated for this article since it changes the displacement and the location of the metacenter. Clearly the center of buoyancy will rise further above the keel when the displacement increases and the value of r as given by equation (5) will decrease; as these two influences are contrary and as neither is very effective (except for enormous additions of weight), we may usually ignore changes of the metacenter and concentrate our attention to the weight and the location where it is added.

For merchantmen the center of gravity is commonly near the waterline; so there is a general understanding that adding weight above the waterline decreases stability and adding below the waterline increases stability. The first is likely to occur during the outfitting of a steamer or during service, because all sorts of appliances are likely to be placed on the decks; a ship may even become unstable when light from this cause. On the other hand the cargo goes into the hold and the ship may become too stiff if heavy cargo is stowed low.

Removing a weight is merely the contrary of adding a weight. Weight removed from the hold, as during unloading, raises the center of gravity of the ship. This may go on until the ship becomes unstable and then is liable to give a lurch unexpectedly. In the days when steamers carried yards, one, which was unloading at East Boston, thrust her yards down through the roof of the warehouse on the dock. A more distressing accident happened when an express steamer was unloading and coaling at the same time from a lighter alongside, all the side lights were open for ventilation. Suddenly the steamer lurched and taking water through the ports, sank at her berth; and this was in the busy passenger season.

Danger from Grounding of Vessel

When a ship grounds on the keel with a falling tide, there is great danger that she may fall over, because the reaction of the bottom has the same effect as removing a large weight at the keel, and the virtual center of gravity is likely to rise above the metacenter. That this danger is not suppositious is indicated by the fact that ships sometimes fall over in the dock, most frequently when undocking. A certain royal naval constructor was most unjustly blamed for such an accident to a royal yacht. As another example we may quote the well known danger of grounding a small boat on the beach, even in fair weather unless men are told off to go overboard and hold the boat. Many an amateur canoeist has learned this danger to his discomfort if not to the peril of others.

One of the most fertile causes of instability is the presence of loose water in a ship or boat. To make this matter clear we may direct attention first to the fact that a suspended weight is applied at the point of suspension; the moment a weight is free from the deck it is applied at the head of the boom and has its full effect on raising the center of gravity of the ship. Now water contained in a receptacle is the inverse of a floating body and has much the same properties. In Fig. 8 the water in a tank has its mobile center of figure at B and directly over is the metacenter to be located by aid of equation (5). The water in fact acts as though it were suspended from the metacenter M and must be assumed to act at that point when considering its effect on the virtual center of gravity of the ship. Of course when a closed receptable is once full of water it acts like a solid and its weight is applied where it is.

Effect of Loose Water in a Ship

A curious and frequently distressing feature of loose water is that a small amount has a high metacenter. This comes from the fact that the distance MB is

$$r = \frac{I}{V}$$

which becomes very large when V is small. We have in mind that

$$I = 1/12\ B^3L$$

from which it is evident that one way of curbing the rise of the virtual center of gravity is to reduce the beam B of the tank. This is one of the reasons for putting in midline bulkheads, which evidently makes B half as much and therefore greatly reduces the moment of inertia. A notable instance of the reduction of beam of free fluid is the form of expansion trunks of oil steamers; they are placed amidships and are very narrow so that the mobility of the oil has little effect.

During the loading or unloading of an oil tanker the compartments (or some of them) are partially filled and instability is likely to occur. The designer of the ship must make due provision to ensure that there shall not be any danger of capsizing; very commonly a tanker takes a list when unloading that may amount to 15 degrees, but if the designer has taken this into account the crew take that as a matter of course.

A very perplexing condition may arise if a ship, when light, loses stability due to burning of coal. If the ship has

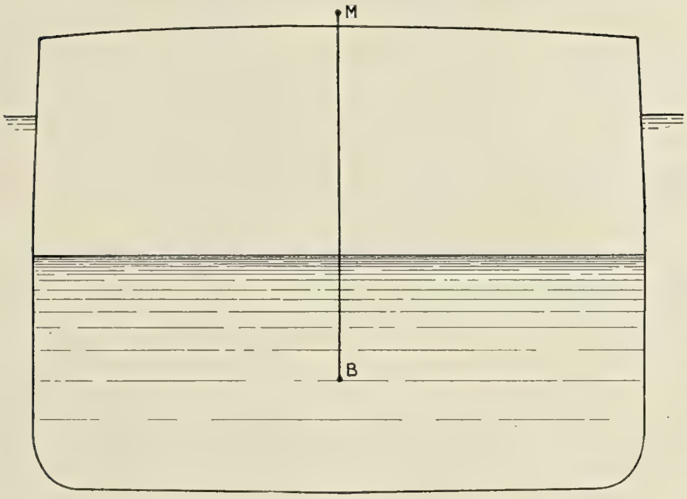


Fig. 8

water ballast tanks, the natural remedy would be to run in water; but in such case the captain must bear in mind that the first effect is to diminish the stability. But if all side openings are closed and if one compartment is dealt with at a time, there may be no occasion for alarm even though the ship should take a small list.

A very simple experiment will show some of the effects of flooding compartments. Take a common biscuit tin and set it afloat in a pan of water; the box will leak at a convenient rate. Since the metacentric height of a shallow layer of water is great, the box immediately becomes unstable and takes a list that increases more and more; but after a while the limit is reached after which the box rights and finally goes down upright.

A Mishap That Might Have Happened

Accidents that don't happen attract little attention; usually some one is blamed for being a busybody; but the old adage holds that it is better to be safe than sorry. One of the numerous pageants of recent years had as a prominent feature a magnificent barge 80 feet long and 20 feet wide all plastered over with stucco work and with a high deck to properly stage the participants. Now the designer of the barge knew it had immense initial stability and did not want interference by carping critics, so details were kept in the architects' office—not a naval but an ordinary architect. But some of the probable passengers became concerned at the policy of secrecy and the plans were submitted for official inspection.

The barge had a gasoline engine but also for proper appearance had a crew of oarsmen under the deck; the freeboard to the oar holes was of course trivial. Two cautions were impressed on the director of the pageant: (1) Keep the hold dry (this to avoid the cracker box effect) and (2) Keep the passengers from rushing over to the rail. These rules, rigorously enforced, cut out all chance of a disaster. But the architect, or somebody else, thought that more stability would help and put in a lot of sand ballast which was of course worse that futile because it lessened the freeboard and would have no effect whatever on mobility of water that might leak in. As previously stated, however, nothing happened until after the spectacle, when the barge drifted from her moorings and was wrecked on a mud flat. But computations showed that an inch of water in the hold or a rush of the passengers to the rail would submerge the oar holes after which anything could happen.

Let us contrast this commonplace affair with the capsizing of the *Eastland* in the Chicago river while taking on passengers for an excursion; a disaster that had its grewsome tale of loss of life. The published account of the investigation was inconclusive, but it is pretty certain that some water ballast tanks were partly filled and there is some question whether or not she touched bottom. A crowd of passengers at one rail was a condition evident to everyone.

The Seaworthiness of Small Boats

The writer had at one time an honorary connection with the life saving service and acquired a great interest and some trivial knowledge of small boats, not to mention his experience with canoes and skiffs. Now a good ship's boat in the hands of an able seaman is in reality a little ship competent to make long sea voyages. An acquaintance of the writer, a competent sea man, considers a voyage of 1,200 miles in such a boat as all in the day's work. That is what can be done with a well found boat. That is the kind of boats carried by ships in former years and familiar to passengers as occupying good deck room. Then came the wreck of the *Titanic* with its fearful loss of life. Legislators could easily order boats enough on every ship to accommodate all aboard; and to conform to the letter of the law the shipping companies took on board various forms of collapsible boats. Now a plain collapsible boat is evidently a poor substitute for a real boat; and yet when set up and put overboard it has saved life; it did on the doomed *Titanic*.

But the ordinary collapsible boat met the approval neither of the authorities nor of the traveling public and a variety of semi-collapsible boats was put on the market, accepted by the authorities and put aboard steamers. The lower half was built of wood or metal and provided displacement to carry the load; the upper or canvas half, when drawn up, made the craft look more like a boat and at least could keep off wind and spray. Like all compromises they were more or less unsatisfactory; when in good condition and in still water they might be useful but in service conditions any of them might be a delusion if not a snare. But they filled the letter of the law—an unreasonable law, incapable of fulfillment. The worst of them had a pontoon body and were so flat and shallow that they were more or less like a raft with the virtues and defects of a raft.

At first sight such a boat may appear more stable than a standard lifeboat; at least the empty boat had a greater metacentric height; but the passengers were carried on the deck and had a high center of gravity. Any water on the deck would have its usual tendency to instability with the further ing toward instability; the pontoon was liable to leak after exposure on the ship's deck and loose water in the pontoon would have its usual tendency to instability with the further condition that it could not be bailed out. Fortunately most of these substitutes for real boats are now discredited and retired from service.

Reference was made a moment ago to the virtues and de-

fects of rafts. Now a raft has a large area and small draft so that its moment of inertia and metacentric height are very large; in smooth water it is very stable. It faithfully follows the surface of large swells in a seaway, but smaller waves come aboard and reduce the stability on account of reduction of the moment of inertia. A raft is liable to dip one edge, slide sideways, drop its load and then ride the waves securely.

Water in an open boat rapidly cuts down the stability. That is the real reason for bailing frantically when waves break in; should the boat be swamped, it is likely to capsize and spill all its passengers. The pressing danger is instability and an overloaded boat is in the greater danger from that cause.

The old-fashioned sailing and rowing lifeboat is passing out of service being replaced by power boats. The first power lifeboats developed in Great Britain were hydraulically propelled steamboats; the absence of external propellers enabled them to venture onto sand bars and into floating wreckage. They were like small, low tugboats, beamy and decked over. Their crews gained great confidence in them and eventually one was capsized and lost on account of over confidence; that is what happens when bold men go into danger to help others. The American boats have gasoline engines and their propellers are in cages or else in tunnels. They were developed from the old sailing and rowing boats and are handy, capable craft.

The typical lifeboat, developed in Great Britain and extensively used on our Great Lakes, was a powerful whale boat with a deck, high ends and a heavy metal keel. The deck above the waterline prevented foundering, and the combination of high closed ends and a heavy keel made the boat self-righting. These boats had a deservedly high reputation and the crews had an enthusiastic confidence in them. They were so big and heavy that they were habitually launched from fixed ways at the harbor mouth. Frequently they were towed to the windward of a wreck; after the rescue they were sailed and rowed to some haven of safety. These boats had a high reputation for stability; as a matter of fact the stability was purposely limited to secure self-righting when capsized. When capsized they were logy in still water but rolling around among waves they quickly righted. They carried gear, crew and passengers on a deck above the waterline and required skillful handling when so loaded. They were great boats and had their crews' absolute confidence.

It is related that one of these lifeboats when towed at speed by a revenue cutter to a wreck, capsized three times and each time righted without losing her crew.

Electric Propulsion of Ships*

Diesel-Electric Propulsion—Reliability—Weight—Economy—Control—Electric Drive on Warships

By W. E. Thau†

FOR practical reasons, direct current only is feasible with Diesel-electric drive. This will be evident by a proper analysis of the performance of Diesel engines in connection with the characteristics involved in applying alternating current and direct current machinery, due consideration of ship requirements being taken into account. To obtain the best results with Diesel-electric drive, it is necessary to provide several relatively small and moderately high-speed generating sets for supplying power to single or doube-unit direct connected propelling motors. Not only must the generated power divide evenly or proportionately between the generating units, but the system must also be such as will conveniently and economically lend itself to speed control to meet the requirements of service.

In the case of alternating current, it would be necessary to operate the generators in parallel. To operate alternating current generators in parallel necessitates the very closest speed regulation and practically identical angular velocities of all prime movers. To visualize properly this exacting requirement, it must be remembered that satisfactory parallel operation of alternating current generators necessitates that the angular displacement of the field poles of one machine with respect to another must not vary more than approximately ± 3 electrical degrees, or a total of 6 electrical degrees. Since 360 electrical degrees constitute the space between adjacent like poles, the total variation in mechanical degrees, for example, in the case of a 20-pole machine, must not exceed 0.6 degree. While successful operation under such requirements is carried out in several land installations where the prime movers operate at constant speed, it is not considered safe practice on board ship *where the necessity for varying the speed of all sets simultaneously* introduces another very serious difficulty. To overcome this condition successfully, would require absolutely perfect engine governors which would function 100 percent perfect at any speed setting. The speed of the motor could be varied by the rheostatic method, thus allowing the engines to operate at constant speed; however, this method is extremely wasteful at reduced speed operation, and at best offers a solution for only one of the many difficulties. It is for these reasons that alternating current is not suitable for Diesel-electric propulsion.

Direct current not only obviates all of the above difficulties, but possesses many advantages in the way of operation, control and reserve power. With direct current, we have the choice between two methods of generator operation, *i. e.,* parallel and series. From the standpoint of engine performance only, parallel operation of direct current generators is entirely feasible and easily accomplished. However, when considering economical methods of speed control of the propeller motors, another factor enters which makes parallel operation difficult, even with direct current machines. This is explained below.

With direct current, we have a choice between two methods of motor speed control, *i. e.,* armature rheostatic and generator voltage control. Armature control is not only unjustifiably wasteful at reduced speed operation, but also adds complication to the control. On the other hand, the voltage control method is practically 100 percent economical and provides an ease and a flexibility of control unapproachable by other systems. In the case of very small drives, armature rheostatic control might be selected because of factors not related to the propulsive equipment making it preferable to have a constant voltage system which is common to the propulsion and auxiliary circuits. For a drive of any appreciable size, the best results are obtained by isolating the propulsive equipment so that immediate maneuvering can be done without affecting non-related circuits. Therefore, hav-

*Concluded from December, 1921, issue.

†Marine department, Westinghouse Electric and Manufacturing Company.

ing an isolated plant for propulsion only, voltage control is obviously the method to use.

With parallel operation of generators, voltage control is not simple of accomplishment. To vary satisfactorily the voltage of two or more generators simultaneously over the full range from zero to maximum, necessitates very closely and very carefully adjusted field rheostats, generators with practically identical saturation curves, and engines with practically identical regulation; or, some complicated and delicate automatic voltage balancing instrument.

The series arrangement of generators, however, is ideal from every standpoint such as operation, control, economy, simplicity, flexibility, reserve, etc. The series arrangement, in eliminating parallel operation of generators, obviates the necessity for close regulation and hence simple engine governors and simple field rheostats are entirely satisfactory. In other words, satisfactory operation is independent of variation in voltage between the different generators.

Besides the operating advantages, the series arrangement inherently provides for full power from each of the remaining generators in case of casualty to one or more of the generating sets without providing additional capacity, and consequently additional weight in the motor. To obtain full power from each of the remaining sets with parallel operation would necessitate increasing the motor field in order to lower its speed to such a value as would require the total capacity of the remaining units, thus necessitating a larger and heavier motor.

Fig. 5 shows a diagrammatic scheme of connections for a single screw Diesel-electric drive. In this particular case, there are six generating sets and one double unit direct connected motor. The six generators and the two motor units are connected in series. The machines are distributed electrically as follows: three generators, one motor unit, three generators and one motor unit, to reduce the voltage strain, or the maximum voltage to ground at any two points to one-half the total voltage of the system. The voltage of each generator being 250, we have in effect a 1500-volt system with only 750-volt insulation requirements. The advantages of this arrangement are obvious, especially in the case of large capacity drives and where there are several generators involved. The diagram shows an arrangement for using as many as may be desired of the main generating sets for supplying power to the ship's auxiliaries when in port. Although the generators (and motors) operate as pure shunt machines when driving the ship, series windings on the generators are automatically placed in circuit when the generators are connected to the auxiliary bus, and therefore, the generators operate as compound machines when supplying the auxiliary load, and when used for this purpose the generators are operated in parallel. Arranging the generators for supplying power to the ship's auxiliary bus determines the voltage of the individual machines (250 volts).

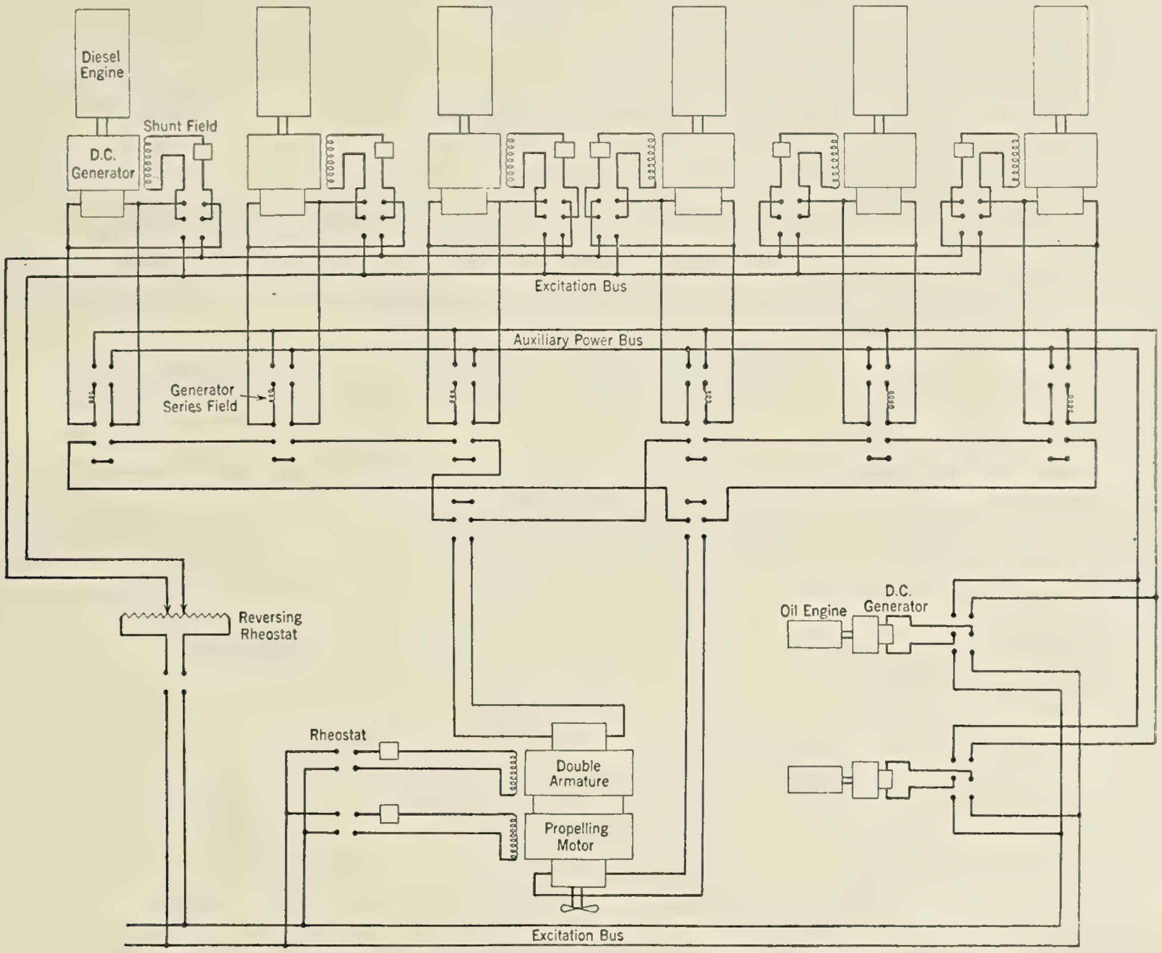


Fig. 5.—Diagrammatic Scheme of Connections for Diesel Electric Drive

The motors and generators being pure shunt-wound machines, the motor speed is adjusted to any value within the requirements by the voltage control system. In this system, the generator and motor fields are separately excited (preferably from the same excitation source). The motor fields are excited at constant potential, and in one direction, whereas the generator field excitation is varied to obtain the motor speed desired. With this arrangement, the speed of the motors is directly proportional to the generator voltage and, therefore, any motor speed from zero to the maximum in either direction is obtained by merely manipulating the generator field rheostat (a common rheostat is used for all generators). Since the rheostat handles only the generator

field current which is 1 percent to 1½ percent of the generator rating, the simplicity and economy of the control is obvious. With the type of rheostat used, the excitation of the generators may be varied from full excitation in one direction to full excitation in the opposite direction, without opening the field circuit, and therefore, the ship can be brought from full speed ahead to full speed astern without opening a single circuit.

Reserve power in the event of casualty to prime movers is greater with this type of drive than with any other. On the basis of the power varying as the cube of the speed, a three-engine unit Diesel-electric ship can make 88 percent speed with two generators and 70 percent speed with only one generator.

The Diesel-electric has the greatest range of application of any of the economical drives (geared turbine and turbine-electric not excepted). Because of the inherent merits of this drive, it is very suitably applied to merchant ships, barges, river boats, lake boats, ferry boats, small coastwise vessels, yachts, fishing boats, coast guard cutters, cable laying ships, and any ship within its capacity requiring refined control and economical operation over a wide range of speed.

As compared with any type of steam drive, the principal advantages of the Diesel-electric are:

Fuel consumption,
Weight,
Control,
Considerably more reserve power in case of casualty to prime movers.

The principal advantages of the Diesel-electric drive as compared with direct Diesel drive are:

Reliability. Cylinder parts being thinner are not subjected to such high temperature strains in heads and liners as are the large low speed engines, and consequently, there will be fewer breakages of these parts. Years of application and service demonstrate beyond a doubt the full reliability of electrical machinery.

Maneuvering Ability and Control. The control is extremely simple, easily understood, and can be placed anywhere on the ship. The engines run at constant speed and hence the engine reversing gear is eliminated.

Weight. On a very conservative basis, the Diesel-electric should show at least 100 pounds less per propeller shaft horsepower.

Propeller Application. Propeller speed not restricted, and in the case of large ships, one propeller would be used for Diesel-electric, whereas, because of engine conditions, two would be used with direct Diesel.

Reserve Power in Case of Casualty. Very much greater with the Diesel-electric.

Maintenance. For reasons under "Reliability," the maintenance should be less. Furthermore, due to smaller parts and reserve power, repairs to Diesel-electric engines can usually be made on board ship while under way, providing sea conditions permit. The engines for Diesel-electric are designed and built on the same conservative basis as direct drive Diesels, and are not the high speed, short lived submarine type.

Less Starting Air. Diesel-electric requires starting air only during the initial start in port. Subsequent engines may be started electrically. No air is used during reversing and consequently, the air problem is reduced to simplest terms.

Fuel Consumption. There would be little difference in the net fuel oil and lubricating oil consumption as the increased efficiency of screw and the reduced strut losses, with the low speed single propeller Diesel-electric, offset the twin screw arrangement of the direct Diesel. From a standpoint of piston speed, the engines used for Diesel-electric drive are no different than direct-connected engines. (The former exceeds the latter only in *revolutions per minute.*)

Cost. The cost of Diesel-electric in some cases is less than the cost of direct connected Diesel drive on present day figures, and will generally show a greater gap when fully developed along standardized lines.

General Summary for Merchant Ship Electric Drives

In the way of a summary relative to all types of electric propulsive equipments for merchant ships, the following salient features may be reviewed:

1. Electric drive is as reliable as any drive suitable for ship propulsion.
2. Maintenance and repairs should not exceed those of other drives, and in some cases should show a saving.
3. Electric drive is ideal for ship propulsion, and will soon be recognized (if it is not already recognized), as a standard type along with the reciprocating engine, geared turbine and Diesel engine drives.
4. Electrical machines have longer life than engines or geared turbines (drives) and do not decrease in efficiency with age.
5. Electric drive (Diesel-electric) is as reliable as any economical drive generally; weighs less than any other drive; is as economical as the best; in most cases costs less than any other drive;* provides more reserve power in case of casualty to prime movers; and affords simplest and most flexible control.

War Vessels

The electric propulsive equipments for war vessels have been described and discussed in many articles in the technical press, and therefore, only the principal phases will be dealt with here.

The fact that the last nineteen capital ships of the United States Navy are, or will be equipped with electric drive, is sufficient testimony in behalf of what the builders and users of war vessels think of its merits. The prime requisite of reliability in any type of machinery designed to propel war vessels was recognized in the electrical machinery at the time of the first installation. Also the calculations showed that the unit fuel consumption over a wide range of operating speeds should be better than anything yet proposed. Service operation of two 30,000-horsepower electrically propelled battleships has indisputably proved that the reliability is all that was claimed, and that the fuel economy as compared with other ships of the same type using direct connected turbines with geared cruising turbines, is vastly superior.

Two other factors in which the electric drive shows a marked improvement over other drives, have been emphasized since the first battleship was built, namely, the superior protection from torpedo attack afforded the machinery by virtue of the arrangement of the electric plant, and the superior maneuvering qualities of the electric drive. The large horsepower requirements of the present war vessels (60,000 horsepower and 180,000 horsepower) preclude the use of reciprocating engine drive, and this leaves electric drive with a decided maneuvering advantage over any other form of turbine drive.

Of the two types of electric propulsive equipments, only the turbine-electric is suitable for propelling war vessels, because of the large capacities required. The nineteen drives installed and building employ essentially the same system in that induction motors are used in all cases. In details, the systems differ in regard to the type of induction motor. Of the three ships in service (the *Maryland* having been recently commissioned), the *New Mexico* motors have the double squirrel-cage rotor winding, the *Tennessee* motors have the form-wound rotor with external starting and maneuvering resistance, and the *Maryland* motors have combined single squirrel-cage and form-wound rotors. Each of these

*It is predicted that future developments will bring the item of cost below that of any other drive.

ELECTRICALLY PROPELLED WAR VESSELS IN SERVICE AND BUILDING

Ship	Kind	Total S. H. P.	Type of drive	Tonnage	Date
U. S. S. *Jupiter*	Collier	7,000	Turbine-electric	20,000	1912
" *New Mexico*	Battleship	28,000	" "	33,000	1918
" *Tennessee*	"	28,000	" "	33,000	1920
" *Maryland*	"	28,000	" "	33,000	1921
" *California*	"	28,000	" "	33,000	Building
" *Colorado*	"	28,000	" "	33,000	"
" *Washington*	"	28,000	" "	33,000	"
" *West Virginia*	"	28,000	" "	33,000	"
" *South Dakota*	"	60,000	" "	43,000	"
" *Indiana*	"	60,000	" "	43,000	"
" *Montana*	"	60,000	" "	43,000	"
" *North Carolina*	"	60,000	" "	43,000	"
" *Iowa*	"	60,000	" "	43,000	"
" *Massachusetts*	"	60,000	" "	43,000	"
" *Lexington*	Battle Cruiser	180,000	" "	43,500	"
" *Constellation*	" "	180,000	" "	43,500	"
" *Saratoga*	" "	180,000	" "	43,500	"
" *Ranger*	" "	180,000	" "	43,500	"
" *Constitution*	" "	180,000	" "	43,500	"
" *United States*	" "	180,000	" "	43,500	"
Japanese Fuel Ship	Collier	8,000	" "	20,000	"
4 Coast Guard Cutters	Cutter	2,600	" "	1,600	"

ELECTRICALLY PROPELLED MERCHANT AND MISCELLANEOUS SHIPS IN SERVICE AND BUILDING

Ship	Kind	Total S. H. P.	Type of drive	Tonnage displaced	Date
2 Ice Breakers at Niagara Falls	Tug	50	Trolley or cable-fed, d-c.	......	1906
Joseph Medill	Fireboat	400	Turbine-electric d-c.	......	1908
Graeme Stewart	Fireboat	400	Turbine-electric d-c.	......	1908
Electric Arc	Experimental Launch	25	Petrol-electric a-c.	......	1911
Tynemount	Cargo	500	Diesel-electric a-c.	......	1912
Mjolner	Cargo	950	Turbine-electric a-c.	......	1912
Wulsty Castle	Cargo	1,500	Turbine-electric a-c.	......	1918
Aquila, etc.	Cargo	1,200	Turbine-electric a-c.	......	1918-9
Mariner	Trawler	400	Diesel-electric d-c.	500	1919
Eclipse	Cargo	3,000	Turbine-electric a-c.	16,000	1920
Cuba	Cargo and Passenger	3,000	Turbine-electric a-c.	3,580	1920
Elfay	Schooner Yacht	90	Diesel-electric d-c.	313	1920
Guinevere	Schooner Yacht	550	Diesel-electric d-c.	1,160	1921
Invincible	Cargo	3,000	Turbine-electric a-c.	......	Building
Archer	Cargo	3,000	Turbine-electric a-c.	......	"
Independence	Cargo	3,000	Turbine-electric a-c.	......	"
Alcyone	Schooner Yacht	350	Diesel-electric d-c.	......	"
Velero II	Schooner Yacht	215	Diesel-electric d-c.	......	"
Fordonian	Cargo	850	Diesel-electric d-c.	2,200	"
8 Cargo Carriers		3,000	Turbine-electric a-c.	16,000	"
Poughkeepsie—Highland Ferry	Ferry	200	Diesel-electric d-c.	640 DWC	"

arrangements has its advocates. However, continued service alone will decide which method is the most suitable, all factors being considered.

Because of limitations in weight and space factors, electric drive is not well suited to small, high power, fast craft such as destroyers and scout cruisers. In the case of ships where conditions are suitable for electric drive, the following discussion of the more important factors will be of interest:

Reliability

In all phases of the industrial field where electricity has entered, it has proved its reliability. With a good record for reliability behind it, electricity has set out to establish a similar record on the sea, and the experience of the two large battleships thus far equipped with electric propelling machinery, and in service, shows that there will be a duplication of past satisfactory performance. The electrical machinery will be found to be in good condition long after the ship has become obsolete.

The arrangement of units and distribution of power make it possible to supply balanced power to all screws in the event of casualty to one of the prime movers. In other words, the electric drive possesses an inherent advantage in regard to reserve power.

Economy

Regardless of calculations, the recorded performance of the electrically propelled battleship *New Mexico* has proved the superiority of the electric battleship in respect to fuel consumption. Recently published figures show that the *Idaho* and *Mississippi* use 20 percent more oil at 10 knots than the *New Mexico;* 42.7 percent more at 13 knots, 48 percent more at 16 knots, 40.1 percent more at 19 knots, and 32 percent more at full power. This superiority in fuel consumption is not altogether due to the main units, as the figures include the oil consumed by the auxiliaries. There is enough difference, however, to show conclusively that the comparison is very favorable to the electric ship.

To show that the advantage in fuel consumption demonstrated by the *New Mexico* is not a mere incident, it is well to note that the *Tennessee,* which is a later ship, is showing even better results than the *New Mexico,* as was indicated when the two ships steamed together during recent maneuvers of the Pacific Fleet. Accurate measurement of unit fuel consumption during the official trials of the *Tennessee* showed that the actual steam consumptions were less than the guaranteed figures by amounts varying from 3 percent to 8 percent approximately. Thus the art of electric propulsion is still progressing. The answer is found in the use of only a sufficient number of turbines for the load conditions, and in the two speed motors, the combination of which maintains a higher average load on the turbines at a higher average speed.

Maneuvering

Owing to the availability of full backing power in the case of the electric drive ship, the latter possesses a marked advantage over the turbine ship in maneuvering qualities. As these were referred to under "Merchant Ships," it is sufficient merely to mention at this time that electric battleships can be stopped in considerably less time than is required to stop a turbine ship. The advantage of this feature is obvious in the case of a war vessel. This is due to the combined action of quicker "set-ups" and greater backing power.

Further maneuvering advantages of the electric drive are apparent from recent publications. These advantages are chiefly concerned when entering and leaving ports and maneuvering therein. By operating the ship from one turbine set, the other, or others if there are more than two, can be held in readiness for immediate service in case of necessity such as would arise from a mudded condenser or other cause. When maneuvering to get under way, operation from a single generating set inherently enables exactly the same speed—but of opposite direction—to be obtained on the port and starboard screws. This is very desirable for the reason that the ship can be turned on its heel without making any headway. With different prime movers supplying power to

the various screws, it would be difficult to maintain all the screws at the same speed and thereby turn in the same space.

Control

The control for the propelling machinery is centralized in one compartment and can be easily arranged to be operated by one operator. The flexibility of the control is such that almost any emergency resulting from casualty to any equipment connected with the propulsive machinery proper, can be taken care of in brief time by disconnecting the disabled unit from the source of power.

Maintenance

The maintenance and repairs should show to advantage because of the inherent reliability of electrical machines and the absence of wearing parts. Repairs of considerable magnitude can be made aboard the ship without removing the machinery. It is difficult to imagine a casualty to any one of the electrical units which could not be repaired on board the ship if circumstances warranted it.

Study of Performance

The electrical instruments enable accurate and convenient observations to be made of the performance of the screws at any instant. The electrical instruments also provide a means for quickly detecting improper performance of the screws due to excessive shaft friction or damaged blades. The performance of all units as indicated by the instruments is under the observation of the watch officer and control-room attendants at all times.

Memorial Tablets for Captain Ericsson

MARCH 9, 1922, will be the sixtieth anniversary of the battle of the *Monitor* and *Merrimac* at Hampton Roads, Va., which demonstrated the merits of the turreted battleship. That has been the date selected by the DeLamater Ericsson Tablet Committee of the American Society of Mechanical Engineers to memorialize the services of Mr. Cornelius H. DeLamater and Capt. John Ericsson, who for 50 years, 1839-1889, were pioneers in developing the naval, marine and industrial interests of this country, and who at the time of the Civil War, without thought of personal reward, turned their mental and financial resources to account and applied their knowledge and experience to accomplish what the Government had failed to do.

The Government has appropriated $35,000, and private individuals have subscribed a larger sum for a memorial to Captain Ericsson, in Washington adjacent to the Lincoln Memorial, and $5,000 is being raised by private subscription among engineering and marine interests to erect bronze tablets on four sites of buildings in New York City with which the lives and work of the two men were identified.

These are (1) the Phoenix Foundry, 260 West Street, between Laight and Vestry Streets, where the first iron boats in this country were built and the screw propeller was first introduced on river and ocean steamers. Some of the equipment of the *Princeton,* the first battleship with machinery and boilers below the water line safe from cannon shot, was constructed there, revolutionizing the navies of the world. The 3-inch pipe for the Croton Aqueduct and hot-air engines to pump the Croton water to the upper floors of houses were conceived and built there, as well as much other notable work. (2) The DeLamater Iron Works, foot of West 13th Street, where many industries now internationally established obtained their first development. There the first self-propelled torpedo, the first torpedo boat, the first submarine boat, and the engines for the original *Monitor,* were built, and the *Dictator* was built complete. (3) The Continental Iron Works, Greenpoint, Brooklyn, L. I., where the hull of the original *Monitor* was built and the *Puritan* and other monitors were built complete; and (4) No. 36 Beach Street, where Captain Ericsson lived and worked and died. By the *Monitor,* the navies of the world were revolutionized a second time.

The DeLamater Ericsson Tablet Committee announces that it has had a communication from the Board of Directors of the Association of Swedish Engineers (Svenska Teknologforeningen), Stockholm, Sweden, stating that they will hold a celebration of the sixtieth anniversary of the battle of the *Monitor* and *Merrimac* simultaneously with the celebration which the committee will hold in New York and Washington on March 9, 1922, as announced in the September issue of *Mechanical Engineering.* It is expected that members of the Royal Family and the American minister to Sweden will be present at the Swedish memorial meeting.

Portable Taper Boring Bar Has Wide Application in Marine Field

FOR such work as reboring propellers or other machine work where a tapered hold is required a portable taper boring bar has been developed by the Pedrick Tool & Machine Company, Philadelphia. So far as known, this is the first portable bar having the feature of adjustment for any required degree of taper.

Its operation is the same as that of the regular cylinder boring bar developed by the company in that the piece being

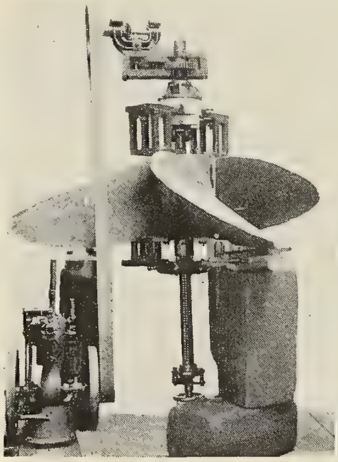


Fig. 1

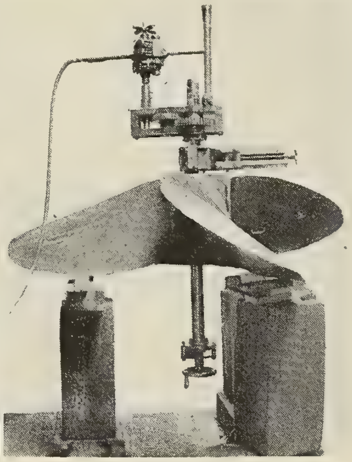


Fig. 2

bored serves as a support for the machine (Fig. 1). To this piece are fastened the crossheads that hold the boring bar. These crossheads have four set screws arranged radially for the final alinement of the bar after it has first been roughly centered in the hole to be bored. The conical motion of the bar which gives the hole the proper taper is derived from a cross slide and yoke in which the bar is secured by a gudgeon pin. The degree of taper is controlled by the distance the slide is moved from its central axis. The lower end of the bar to which the feed case is attached describes a circle. By preventing the hand wheel of the feed case from turning, either by means of a weight or some other simple method, the feed becomes constant and automatic.

The driving gear is stationary so that it may be belt driven or by an air drill or electric motor in either the vertical or horizontal positions.

In Fig. 2 the facing arm attached to the device is shown machining the hub of the propeller. This operation requires the removal of the crossheads and space blocks used in the boring operation and the attachment of a different device for holding the bar. This device consists of "spiders" which are held in the bore of the hub both on the top and bottom by projecting set screws.

Calking Materials for Shipbuilding Purposes

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

THE principal calking materials dealt with in this article are those required to make the seams between strakes of planking or wood decking watertight. The calking of steel is a metal to metal operation; and such packing as is occasionally required on steel ships, and the red lead putty or tallow mixtures used in stopping up otherwise inaccessible crevices on both steel and wood ships call for but brief mention.

In the calking of a wood hull or deck the seam is first nearly filled with calking cotton or oakum, or both, as the main calking materials and these are then protected by a covering of seam composition, marine glue, pitch or cement. Wood calking wedges are sometimes used for the inside ceiling of wood vessels and for floating dry docks and other special work. These different materials will now be considered.

Oakum

Oakum is a mass of strong pliable vegetable fibers which have the property of swelling when wet and are therefore called soft fibers. The fibers are impregnated with pine tar and are loosely bundled together. Before oakum is used it is worked or "spun" into "threads" which run from 40 to 75 feet in length to the pound; this spinning is done either by the manufacturer or at the shipyard. The fibers must not be too springy and on the other hand they must not be so soft as to calk into a hard wedge without elasticity.

The best fibers for marine oakum are Russian hemp; Italian hemp is next best. Sunn, sometimes called Sunn hemp, is an East Indian plant with fibers of the proper strength, absorbent qualities and resistance to decay to make good oakum but somewhat inferior to Russian and Italian hemp; Benaries is another Indian plant of the same nature.

American hemp fibers are somewhat too soft and inferior in elasticity and an oakum made entirely of them will pack solid and give poor service. Flax fibers are good but being usually more expensive than and not as good as hemp are naturally not much used.

Jute, which is the fiber from either of two other East Indian plants, does not make satisfactory oakum for shipbuilding purposes as it is more woody and weaker in tensile strength than the fibers before mentioned and is subject to rapid decay from moisture.

Oakum is often adulterated by the use of hard fibers such as Yucatan henequen, Java sisal, New Zealand flax and the ixtles, which do not swell when wet; but these can be readily detected. Not only are they not suitable in this respect but they are springy and cannot be properly wedged into the seams. Their use should therefore be absolutely prohibited.

The fibers for oakum may be new or obtained from cutting up old tarred hemp rope into short lengths and pulling the fibers apart. The oakum made from new fibers is preferable, being free from the knots or unravelled yarns which are unavoidable with oakum made from old rope.

In the spring of 1918 on account of the large amount of oakum required for the wood ships of the United States Shipping Board Emergency Fleet Corporation, the Bureau of Plant Industry of the United States Department of Agriculture and the Bureau of Standards of the Department of Commerce made an extensive study of oakum fibers. Later in the year specifications for several grades of oakum were prepared and presented to a conference at the Bureau of Standards attended by the Government bodies interested and the oakum manufacturers. The provisions of the specifications as approved by those present show clearly the relative value of the different fibers and give other information necessary for a proper selection of the material for shipbuilding purposes. They were in substance as follows:

(a) The grade known as No. 1 grade oakum shall be made from Italian, Russian or American hemp (Cannabis sativa), line or tow, or from any No. 1 grade Sunn, or No. 2 grade Benaries, or North Bengal Sunn, or from any combination of these fibers.

(b) The grade known as No. 2 grade shall conform to all the requirements of No. 1 grade except that flax fiber may be used in quantities not to exceed 25 percent of the total weight of the fibers.

(c) The grade known as No. 3 grade shall conform to all the requirements of No. 2 grade except that jute may be used in quantities not to exceed 25 percent of the total weight of the fibers.

(d) The fibers shall be thoroughly impregnated with pine tar to an amount not to exceed 30 percent of the total weight of the fiber and tar.

(e) Hemp (Cannabis sativa) recovered from old rope shall be considered the same as new hemp of the same grade and name.

(f) Where percentage of any fiber is stated it shall be understood that it is percentage of the original weight of fiber before impregnation. The original weight of the fibers shall be determined under ordinary atmospheric conditions.

(g) All oakum shall be thoroughly carded and finished, free from excessive lumps, dirt or other extraneous matter.

An explanation of the foregoing expression, "line or tow," is that the Bureau of Standards defines tow hemp as hemp obtained from the combing out process from the line hemp. Some of this tow is very short stuff that becomes waste when the oakum is spun; the more of this there is, the poorer the oakum. An oakum manufacturer on the lookout for good material can often obtain cargoes or part cargoes of hemp that have been imported for weaving and been somewhat damaged in transit at figures low enough to enable its use in oakum, with a resultant increase in the length of the fibers and the quality of the oakum produced.

The Navy Department specifications for oakum dated March 1, 1919, exactly follow provision (a), without reference to grading, and also provisions (d), (e) and (g) and retain the original Navy provisions for machine spun oakum and for delivery in bales of about 50 pounds each, compressed no more than necessary and securely bound with laths and strong tarred sisal yarns. The provision with regard to spinning is as follows:

> Oakum shall be spun by machine into slivers or threads in the form of balls or hanks not exceeding 5 pounds each; it shall be soft and uniform in texture, strong and sufficiently twisted to be suitable in all respects for calking seams of vessels. The slivers or threads shall contain not less than 43 feet to the pound and not more than 75 feet to the pound, unless otherwise required.

*Member of the firm of Rossell & Thayer, Naval Architects & Marine Engineers, Philadelphia, Pa.

The above specifications as to spinning and packing are trade customs.

One of the best known manufacturers of marine oakum advertises his No. 1 grade of machine spun oakum as averaging about 50 feet to the pound. When a calking machine is used threads 40 feet or less to the pound for the hull, and about 55 feet for decks, have been found to be the most economical.

Machine spun oakum costs about one cent per pound more than the unspun oakum, whereas the cost of spinning it by hand will usually be several times that amount. Moreover, it contains considerably less waste than the unspun oakum. As the spinning, however, is a part of the calkers' work, they sometimes have to be taken into consideration when determining which kind to buy.

With regard to the 30 percent maximum limit of tar, before specified, the writer understands that the most used make of high grade marine oakum contains only 15 to 18 percent of tar. Thorough impregnation or absorption of the tar by the fibers is essential in order that they shall be impervious to water and this necessitates a certain amount of seasoning of the oakum.

It is very poor policy to use on any vessel anything but No. 1 grade of oakum because the cost of the initial calking is a relatively small item and of that cost the labor element is by far the greater part. Subsequent calkings are at the expense of dry dock charges, loss of service of the vessel and other undesirable features.

On account of the high percentage of labor in the calking cost and the knowledge of or ability to determine how many feet of single thread one man or pair of men will do per day, an estimate of the amount of calking material necessary for any vessel is more important from the point of view of the number of feet of thread than of its actual weight.

The following table shows the amounts of oakum and calking cotton that should fill the seams when the planks are properly laid up and the proportions of cotton and oakum that it is desirable to use. It will be noted that the total is one thread per inch of planking thickness.

Thickness of Plank, Inches	Threads of Cotton	Threads of Oakum
2	1	1
3	1	2
4	1	3
5	2	3
6	2	4
7	2	5
8	2	6

Data in possession of the writer of actual amounts of oakum and calking cotton used on wood hulls of 200 feet length and over indicate that a fairly close approximation to the weight of oakum and calking cotton required for seams that are properly laid up can be obtained in the following manner, using for L, B and D, the length from the fore side of the stem at the deck level to the aft side of the rudder post, the breadth molded and the depth molded. Thicknesses are in inches and other dimensions are in feet.

Hull to depth deck — $L \times (B + 2D) \times$ average thickness planking .... (a)
Complete calked decks — Number $\times L \times B \times$ thickness of decking .... (b)
Complete calked bulkheads — Number $\times B \times D \times$ thickness of bulkheads .... (c)
Erections, shaft tunnel, ceiling and other calked work — Area of surface in square feet $\times$ thickness of planking.. (d), etc.

$$\text{Weight of oakum} = \frac{(a) + (b) + (c) + (d) + \text{etc.}}{100} \times 3.5$$

Weight of cotton = about 1/5 the weight of oakum

Calking Cotton

Calking cotton is made from the short stuff or linters resulting from the carding of cotton and from sweepings and similar waste product, which is recarded and spun into threads. It is sold in small bundles and in bales of 50 and 100 pounds. When sold in bales the threads usually run about 50 feet to the pound but they can be readily subdivided to any extent desired. When in small packages the threads are usually thinner. It is graded according to length of fiber, uniformity and cleanness, and the best grade generally obtainable is none too good or too clean.

Cotton is used for calking seams in thin planking which are too small to take oakum efficiently and should be used at the bottom of all seams. It works into the point of the V with less danger of forcing it all the way through; it protects the oakum from decay due to contact with bilge water; and as it is of longer life than oakum it will form a base for any necessary subsequent recalking. In some cases where a vessel is calked entirely with cotton subsequent recalking will be done with oakum.

The preferred number of threads to use and the amounts required have just been considered under the heading of oakum.

Pitch

As before stated, pitch is used to protect the oakum, which is driven well below the face of the planks leaving space for this or some other protective covering. It must be of a nature that will not crumble or crack in cold weather or liquify or run in hot weather, which calls for a good degree of elasticity and a melting point around 150 degrees F. There are three kinds of calking pitch on the market—pine tar pitch, asphalt pitch and coal tar pitch.

Pine tar pitch, which results from boiling down pine tar, is the old and tried material that stands up in all weather conditions, is elastic and scrapes clean. The difference in cost between it and other pitch is not usually sufficient to warrant the use of any other kind on marine work.

Asphalt pitch has given good service in a number of cases and has demonstrated a considerable degree of elasticity but it is not the equal of pine tar pitch.

Coal tar pitch, which is made from the distillation of gas house and coke oven tars, is an inferior article and in tropical service will soften and work out of the seam. Some of the older wood shipbuilders consider that it acts injuriously on the oakum, paint and wood in contact with it but it is doubtful if this is true of the present day article produced by reliable manufacturers.

During the recent war the Forest Service reported a possible supply of hardwood pitch but as there was an ample supply of pine tar pitch this was not followed up.

Marine Glue

There are a number of good marine glues on the market, designed to replace pitch as the final filling of seams and protector of the oakum; they sometimes have names such as elastic seam composition, elastic calking compound, etc. Marine glue is preferable to pitch for deck seams on everything except barge, tugboat and other rough work where its slightly higher cost might not be warranted. It should be ordered from a manufacturer whose product has been proved to be successful rather than on the basis of melting point or composition.

In addition to the filling of seams, marine glue is also used in joints of joinerwork of yachts and other craft where special provisions for watertightness are desirable.

Calking Cement

This is simply pure Portland cement mixed up with water to the proper consistency, with the addition of a handful of powdered chalk or lamp black per bucket to retard the setting action. Its use is confined to the seams of the outside planking of wood vessels.

It is objectionable on a new vessel because the shrinkage of the planking and other reasons usually necessitate early

recalking, and the removal of the cement is apt to damage the edges of the calking seams. It is of particular value on unduly wide seams of old vessels. It is also of value against teredo attack.

Where cement is used the oakum and the seam beyond the oakum should first be painted with a seam paint.

Seam Paints and Composition

These are usually proprietary products marketed by specialists in this line and by paint manufacturers. The compositions take the place of pitch, glue or cement in filling out the seams and some makes are used without any preparatory painting of the seams. With other makes a preparatory painting is advisable and the paint for this purpose is usually the composition in liquid form. On small seams paint alone will suffice.

The paints and compositions should be waterproof, durable and where used on the hull below the waterline for salt water service preferably of a nature poisonous to marine wood borers. The best guide to their selection is the results of past service. A mixture of white lead and tallow gives good service in hull planking seams.

Calking Wedges

As before stated, wood calking wedges are sometimes used for the inside ceiling of wood vessels and for floating dry docks and other special work. They add greatly and most beneficially to the stiffness of the structure.

The wood used should have the property of swelling considerably when wet, and white pine is ideal for this purpose. White pine calking wedges are a staple article of commerce. The heartwood of thoroughly seasoned bald cypress, red cedar or Douglas fir may be used, subject to classification or other necessary approval.

A convenient size of wedge is 4 inches deep, with a thickness of 7/16 inch at the butt and tapering to a point, and with a width of 3⅝ inches at one end and 3¼ inches at the other. Alternate wedges having the larger width at the point are first driven and then the intermediate wedges having the larger width at the butt are driven between them. The seams have to be properly outgaged and carefully reamed and cleaned out.

Lead and Tallow Mixtures

These mixtures, while often used to cover up poor workmanship, are sometimes unavoidable for stopping up leaks in otherwise inaccessible places in both steel and wood construction. They are forced into the crevices with compressed air or mechanical pressure from a so-called gun, through a hole drilled or bored in a location that will communicate with the spaces requiring to be filled up.

For watertight work on steel ships a good mixture is a putty made by mixing red lead powder into white lead paste, with a little whiting added where necessary to harden it. For oil tight work on steel ships a good mixture is a putty made by adding sifted powdered Portland cement to equal parts of liquid pine tar and shellac.

For wood ships a mixture of red lead and tallow is used. In and around deadwoods the mixture is made thin but where the trouble is localized a thick pasty mixture is used. The tallow stops the leak and the red lead prevents its caking too quickly and also poisons it so that the rats will not eat it. White lead and tallow to cover the calking in planking seams have been previously referred to.

Packing

Packing is sometimes used as an aid to watertightness in steel to steel calking. Like the mixtures just dealt with it is in the nature of a necessary evil, with a tendency to make use of it where it should not be required. In some cases the use of packing is commendable, such as under doubling plates, along plate landings in repair work where the surface has become roughened by corrosion, and between castings and steel plating.

The packing is ship sheathing felt or thin canvas thoroughly soaked in red lead or some bituminous compound that has been proved to give good results when so used.

President Plans Definite Shipping Policy

Expert Committee Preparing Concrete Plan of Government Aid to Shipping, to Be Submitted Early in January

AFTER several months of consideration the administration has decided that it is impossible to build up an American merchant marine and dispose of the ships now owned by the Government to private companies without some kind of a ship subsidy. President Harding has indicated his intention of going before Congress early in January with a special message in which he will advocate a concrete plan of Government aid to shipping in complete detail and the legislation on this subject is expected to form an important part of the program for the regular Congressional session which opened on December 5.

The exact form of the plan is yet to be determined but is being worked out by the Shipping Board with the assistance of a committee of outside experts working under the direction of Commissioner Meyer Lissner. The White House had previously let it be known that the President had been advised by the State Department that it would be unwise and imprudent to enforce Section 34 of the Jones law, and that the President would recommend a substitute to Congress. The subsidy plan is to be the substitute which will assist the development of American shipping by other means than by a policy of discrimination. In this connection so many objections have also appeared to the enforcement of Section 28 of the merchant marine law, intended to restrict preferential rail export and import rates to freight shipped in American bottoms, that there have been many predictions that it will not be applied.

Form of Subsidy

The study being made under the direction of Commissioner Lissner, which is now taking form, involves not only the question of the amount of assistance required but also of the form of the subsidy, whether a direct subsidy such as the proposal of the shipowners some time ago for a payment of $5 per gross ton per year, or aids, such as for example a provision that 50 percent of the immigrants allowed to enter the United States shall be required to travel on American ships. The recommendations to be made to the President will cover what is necessary in each route or type of service, including what is necessary to take care of the wage differential.

It is believed that some form of subsidy will hasten the time when it will be possible for the Shipping Board to get out of the business of ship operation as it will increase the chances for selling the Government-owned boats. The reasons advanced as to why a ship subsidy is necessary are

first, to enable the American merchant marine to compete with long-established foreign competitors who have been aided by their own governments, and to overcome the higher cost of construction in this country as well as the higher wages paid to American crews.

The proposed 10-year naval holiday is also advanced as a reason for giving some encouragement to shipbuilding on the ground that, if naval construction is practically shut off for that period of time, shipbuilding in this country will become a lost art.

One of the plans under consideration is, in place of imposing discriminating duties on traffic brought to this country in foreign vessels, to devote a percentage of all the duties actually collected to the aid of American ships.

President's Special Committee

Those who are making the study of ship subsidies for the Board are: Professor Emory R. Johnson, of the University of Pennsylvania; W. L. Marvin, vice-president of the American Steamship Owners' Association; Rear-Admiral H. H. Rousseau; Admiral C. S. Williams, Daniel H. Cox, naval architect, Grosvener N. Jones, authority on ship subsidies; Norman Beecher, admiralty counsel of the Shipping Board. Those studying the insurance phase of the situation are: Professor William Leslie, of the University of California; Dr. S. S. Huebner, professor of insurance at the University of Pennsylvania; W. C. Rader, in charge of marine insurance for the Standard Oil Company of New Jersey; B. K. Ogden, in charge of marine insurance for the Shipping Board, and Vice-President W. J. Love of the Emergency Fleet Corporation.

In his address to Congress at the opening of the session on December 6 President Harding discussed merchant marine affairs as follows:

The Jones Act

"The previous Congress, deeply concerned in behalf of our merchant marine, in 1920 enacted the existing shipping law, designed for the upbuilding of the American merchant marine. Among other things provided to encourage our shipping on the world's seas, the executive was directed to give notice of the termination of all existing commercial treaties in order to admit of reduced duties on imports carried in American bottoms.

"During the life of the act no executive has complied with this order of the Congress. When the present administration came into responsibility, it began an early inquiry into the failure to execute the expressed purpose of the Jones act. Only one conclusion has been possible.

"Frankly, members of House and Senate, eager as I am to join you in the making of an American merchant marine commensurate with our commerce, the denouncement of our commercial treaties would involve us in a chaos of trade relationships and add indescribably to the confusion of the already disordered commercial world.

"Our power to do so is not disputed, but power and ships, without comity of relationship, will not give us the expanded trade which is inseparably linked with a great merchant marine. Moreover, the applied reduction of duty, for which the treaty denouncements were necessary, encouraged only the carrying of dutiable imports to our shores, while the tonnage which unfurls the flag on the seas is both free and dutiable, and the cargoes which make a nation eminent in trade are outgoing, rather than incoming.

Plan for Ship Subsidy

"It is not my thought to lay the problem in detail before you today. It is desired only to say to you that the executive branch of the government, uninfluenced by the protest of any nation, for none has been made, is well convinced that your proposal, highly intended and heartily supported here, is so fraught with difficulties and so marked by tendencies to discourage trade expansion that I invite your tolerance of noncompliance for a very few weeks until a plan may be presented which contemplates no greater draft upon the public treasury, and which, though yet too crude to offer you today, gives such promise of expanding our merchant marine that it will argue its own approval.

"It is enough to say today that we are so possessed of ships and the American intention to establish a merchant marine is so unalterable that a plan of reimbursement, at no other cost than is contemplated in the existing act, will appeal to the pride and encourage the hope of all the American people."

The Most Interesting Job in the Yard

Here is another contender in the controversy over which is the most interesting job in the yard. In the October and November 1921 *issues were published the claims of a machinist in the engineering department of a ship repair yard and of an engineer in the office of a large shipyard. Now comes a veteran who not only has designed engines but has erected them in the shop and operated them on board ship. How does YOUR job compare with these? Tell us about it and why you think it is the most interesting job in the yard. Who's next?*

THE letter by "Nulli Secundus," page 761, of the October issue, interests me. If a workman of any kind, in any branch of the mechanic arts, is really in love with his work naturally he will think that *his* work in particular is "the most interesting job in the yard." This is what might be called "departmental pride," which is justifiable as long as it does not disbar co-operative effort in production as a whole. So, the correspondent who signs himself as "second to none" thinks the machine work part of the yard as a whole is "the most interesting job." Well, it is interesting but, to me, not the *most* interesting by a good deal.

I have been engaged in various operations in marine engine works and shipyards, from the drafting board to installing the machinery "on board," and then operating that machinery as an engineer's officer of the watch, for several years. (Incidentally I held a chief's unlimited tonnage certificate.) Therefore, I would like to add my "say so" in regard to the matter.

I think the most interesting job in the yard is the erection of the engines in the shop, and next to that, the installation of the engines in the ship. The erecting engineer *must* know something more, both in detail and as a whole, than is required of any of the "tool hands" (or "machine hands," which is perhaps the better expression). The bringing together, the assembling of the various parts of the engine requires more than merely bolting them together. Measurements must be checked up from blueprints and dimensions compared for accuracy of the work as turned out by the various machines involved. Mistakes may be made, and pass unnoticed, while the process of machining is going on, but those mistakes must be discovered in the process of erection, else serious consequences may follow.

In my contention that "the most interesting job in the yard" is the assembling and erecting of the various parts which make up the whole, let us consider the erection of a three cylinder, triple expansion reciprocating marine steam engine. I shall touch only the "high spots" at this time as time and space do not permit of going into a full and detailed description and explanation.

We will assume a suitable shop in all aspects in which such an engine may be built from start to finish. The various parts have been designed, patterns and castings made,

forgings turned out from the smith's shop, and all these have been "laid out" from blueprints or other drawings, so that the various machine hands can finish the parts to the required dimensions. This involves all kinds of machine work, such as planing, boring, drilling, turning, slotting, milling, shaping, etc.

The bedplate, having been planed (i. e., the upper surface, upon which the feet of the six columns rest, the openings for the six main shaft bearings to be housed, and also the upper surface of all the housings), is now ready to be "set up," either on the floor or in a pit for that particular purpose as conditions may require. In some work the overhead traveling crane which must handle all the heavy parts is not sufficiently high to permit of a very large engine being set up on the floor level, hence the necessity for a "pit."

The bedplate is set level by wedges under it, the spirit level being applied to the planed surfaces on top. During the erection of the entire engine the bedplate is tested for possible settling down out of level, and, if so found, a readjustment of the wedges corrects the trouble.

Next, the columns are set up, the tops of the six columns and also the feet are supposed to be correctly planed, so that they are exactly the same length and, also, so that when secured by the bolts at the base to the bedplate the tops of the columns are in the same plane and level as the bedplate is. As well as this, the planed faces of the crosshead guides must be parallel, or nearly so, as measured by a gage applied at the top and bottom ends of each pair of columns.

Sometimes it happens that the three planed surfaces of each column are not exactly true with one another, as discovered when setting them all up on the bedplate and gaging distances, etc. In that case, the foot of the column, or columns, must be faced to bring the surfaces true.

After all the columns have been "trued" up and securely bolted to the bedplate through two or more of the holes in the base of each column and in the bedplate, they are reamed and properly fitted bolts are driven in and secured by nuts. Thus the columns are prevented from twisting or getting "out of line" or "out of true" in any direction. Proper precautions are also taken to prevent the tops of the columns springing inwards, towards each other, until the cylinders are ready to be placed thereon. The correct location of each pair of columns, i. e., those for the high pressure cylinder, those for the intermediate cylinder and those for the low pressure cylinder, has been determined by the use of plumb bob centerlines between each pair of columns, gaging between the falls of the guides and by testing with a centerline running fore and aft through the bearings in the bedplate.

Thus by these means let us say that the six columns are correctly set on, and properly secured to, the bedplate, all in correct relationship to one another and according to the dimensions and distances as specified in the drawings. After this the whole structure is tested again for being level.

Next in order is the testing of the tops of the six columns for being in the same plane, level in a fore and aft direction, as well as in the athwartship direction. The test is made by the use of long metal straight edges and also by the use of a spirit level of good design. The top surfaces of the columns must be made right, for, if they are not, the cylinders will not be truly in line. Shims might be used to make up for inequalities of the column tops, but it is better to reface the tops of those columns that are "out" and thus make a correct job of it.

In the meantime, the cylinders have been bored and the various surfaces planed, including the feet, which are to be secured to the tops of the columns. Assume the cylinders to be finished—as far as is necessary for placing them on top of the columns—which means that they are all true with one another, both with regard to the bores and also the planed surfaces, and that the feet are all in one plane, so that when the entire "block" is placed upon the column tops the faces meet and require no "shimming" or "springing" to bring them together.

Then centerlines are run through each cylinder, so as to intersect the horizontal centerline through the bearing housings, and the cylinders are correctly set according to the requirements of the drawings. After the cylinders have been correctly located so as to be in line fore and aft and athwartships, the feet are securely bolted to the tops of the columns. Here, also, two holes (or more if desired) are reamed and fitted with driven-in bolts. All the bolts fitted in the reamed holes should be marked for their respective places, so that after dismantling the engine and setting it up in the ship, the bolts will be correctly placed and all the parts come exactly right again.

So far we have the principal heavy parts of the engine erected and in true relationship and alinement. It is now a matter of correctly assembling the minor parts and by centerlines, gages, levels, etc., set them also in their correct positions, using the drawings as guides for dimensions and location of various parts.

I think enough has been written to support my claim, that the erection of an engine is the most interesting job in the yard.

The erector deals with, and is concerned with, the *whole* machine, while the various machine hands are concerned only with their individual parts to be made. They cannot feel the same interest in the machine being constructed and "set up" as the man, or men, who are employed on the actual erection work. Even the workmen themselves look upon an erector as a somewhat superior man. Why? Because he is engaged in a superior work—a most interesting job. And then, who are the men usually selected "to go down to the sea in ships" as engineers? The men who produce the individual parts of the engines? No, seldom, if ever. The men chosen are those who erected the engine, assembled the parts and made it possible for the machine as a whole "to run" and serve the full purpose for which it was made.

Brooklyn, N. Y. CHARLES J. MASON.

Shipments Via Panama Canal

"IT is evident that the Pacific coast is taking advantage of the cheap transportation which the Canal affords for bulky commodities to eastern United States and Europe," said E. S. Gregg, chief of the transportation division of the Department of Commerce, in a statement on the Panama Canal in which he submitted detailed statistics showing increased tonnage moving via the Canal.

"Steamers in the intercoastal trade are endeavoring to equal the time made by the transcontinental railroads. Oranges and lemons have been shipped from California to New York by water in 19 days. While the railroads occasionally move fruit across the continent in two weeks, the average time is probably not under 20 days. A saving of about 25 percent in rates is effected by the all-water route. It is claimed that the percentage of decay in fruit arriving at Atlantic ports by water is less than when shipped by the rail routes.

"Intercoastal trade through the Canal shows a pronounced increase during this year as compared with 1920.

"During the war and as long as rates were high on foreign traffic, ships were induced to forsake coastwise trade. Since the slump in rates, however, many American ships have returned to the protected intercoastal trade, and an increasing amount of cargo is being carried between the Atlantic and Pacific ports of the United States by water.

"Europe is taking large quantities of Pacific Coast wheat this year; during the first eight months of 1921, 506,058 tons were shipped to Europe, as compared with a total shipment of 749,447 tons of all kinds of cargo during the 12 months of 1920."

Compounding the Internal Combustion Engine*

By Elmer A. Sperry

The compound combustion engine is light compared with the normal Diesel, being in special cases less than one-tenth, and in some instances less than one-twentieth, the weight for the same output. Its mechanical efficiency is extremely high, and a distinct gain in overall efficiency from fuel to shaft has been made, as well as a very definite gain in simplicity, direct performance and smoothness of the crankshaft diagram. This has been achieved while adhering to the four-cycle operation. This paper presents the results of research by the author extending over a series of years, during which not only has the high-pressure principle been thoroughly established, but all the important requirements have been worked out, and finally an engine embodying practically all the advantages has been subjected to long continuous runs.

IN America, a group headed by the author has been engaged on the problem of compounding the internal combustion engine for upward of thirty years. A number of engines have steadily followed each other, each involving improvements resulting from previous experience, until the essential problems have been conquered. Not only has the principle been thoroughly established, but all the important refinements have been worked out, and finally an engine embodying practically all the advances has been subjected to long continuous runs. Data almost invaluable to the art have been secured, together with a series of indicator cards and diagrams that exceed a thousand in number.

The outcome has been that the various prophecies of thoughtful engineers in the past have been more than fulfilled and there is every evidence that the heavy-duty compound combustion engine is everything that was hoped for. It is light compared with the normal Diesel, being in special cases less than one-tenth, and in some instances less than one-twentieth, in weight for the same output. Its mechanical efficiency is extremely high, a distinct gain in overall efficiency from fuel to shaft has been made, as well as a very definite gain in simplicity, direct performance and smoothness of the crankshaft diagram. This has been achieved while adhering to the best practice, namely, four-cycle operation.

Compounds Lighter and Cheaper

The lightness and simplicity of the compound solves the capital-charge factor automatically. Engines of this type weighing only a fraction of the weight of the present Diesel will inevitably be found to be much less in first cost as well as in cost of upkeep.

Our own Government has come forward with orders for an initial engine which, together with orders from other sources, is now under construction. To illustrate to what low figures the compound principle can be relied upon to bring the heavy-oil engine, it should be stated that among these orders is one now under construction to weigh about five pounds to the brake horsepower. This may be looked upon as extreme, but the designed weights and finished parts as they now stand are below this figure. The old single-stage compression is discarded in the compound and the modern method of two-stage compression is adopted.

Chilled Surfaces Reduced

Supercharging or compressing in two stages gives the controlling advantage in that a very much larger unit volume of gases may be handled. The clearance spaces may be many times the size of those in the Diesel, and yet it is perfectly simple to bring these large volumes up to the requisite pressure and incandescent temperatures at the instant of fuel injection.

While retaining all of the chilled walls that are necessary for proper handling of the lubrication, still a gain is made on the order of 60 percent in the extent of these chilled walls in the compound as compared with the simple engine.

Solid Fuel Injection

With the large clearance volume we no longer have difficulty with solid injection, nor do we have any difficulty in using a wide range of heavy fuels. In the compound engine the clearance volume is so large that the entire high pressure piston displacement causes it to lose only a fraction of its pressure, thus bringing to the second stage, or low pressure, both ample volume and pressure so that this piston (representing 6, 8 or even 10 times the area of the high pressure) is driven to the end of its stroke with pressures still above the atmosphere.

Much Greater Expansion, Higher Efficiencies

In this way the engine yields an expansion ratio based on gage pressures, which instead of being 3 or 4 to 1, as in the case of the automobile engine, or about 12 to 1 in the Diesel, can be made as high as 120 to 1. A higher return and greater efficiency from the fuel are secured because of the lower temperature of the exhaust.

Utilizing the Detonation of Fuels

Through a research extending over a year and a half or more, conditions were discovered by means of which "detonation" of the fuels may invariably be secured. The author found that the *thermodynamic efficiency was higher in case of high detonation diagrams* than with low. Our work has been toward realizing these high efficiencies by developing instead of suppressing this high-intensity combustion. One of the achievements of high-intensity combustion is better thermal efficiency and a still further reduction in the exhaust temperatures.

Elimination of Losses in Transfer

In early attempts at compounding it was found that prohibitive losses would occur in the transfer, due to the falling pressures while filling the low pressure clearances. A complete solution of this is found in a special adaptation of the process of "cushioning"—closing the exhaust valve at a predetermined point before the out-stroke end, trapping a little of the hot gases and cushioning them up to the transfer pressure so the transfer valve opens under conditions of equal pressure on each side. There is, therefore, no flow of gases except that due to the slow starting of the strokes of the two pistons. There are practically no losses sustained in cushioning; the power of compression is returned very completely on expansion. In this unique adaptation of cushioning the additional advantage is secured of preventing all erosion due to high velocities of the hot gases over the transfer seats. These seats are amply jacketed and are found to remain smooth, bright and perfectly sealed over long periods. It is incidentally found that in cushioning, the

*Extracts from a paper read before the American Society of Mechanical Engineers, New York, December, 1921.

adiabatic compression of the hot gases brings with it an equality of *temperatures* as well as pressures, so there is neither loss in pressure nor temperature at this critical point of transfer and the efficiencies are carried at high values throughout the cycle. In the compound engine the exponents hold very closely to the adiabatic throughout the cycle due to less cooling, owing to the very low ratio of chilled wall surfaces to unit volume of power gases and the large unit volumes employed.

An important feature of compounding is the complete suppression of all preignition. All the early part of the compression occurs entirely extraneous to the combustion chamber, where air only is handled, and only the latter part or second stage of the compression occurs in the combustion cylinder, so the engine is simplified because no troublesome and often leaky safety valves or pressure relief valves are required or fitted.

The Transfer-Valve Problem

The transfer valve considered as an exhaust valve is called upon to handle much hotter gases than ever heretofore. A difficult situation is here presented. Are special materials necessary and how can the valve successfully perform this duty? It is known that the exhaust valves of the Liberty motor run red hot and the stems white hot, and yet they are handling gases of lower temperature than are here present.

Compression in the compound is by the modern two-stage method. Air is admitted to the combustion chamber under comparatively high pressure and although it is warm, yet with each atmosphere of pressure its cooling powers are doubled. Air at 100 pounds thus has seven times the cooling power of atmospheric air, seven times the weight and seven times the molecules in contact for cooling. In forcing the high-pressure piston down, air must pass some port in entering. Now, as a matter of fact, this port is in line with the transfer port and the induction valve itself rides on the back of the transfer valve in the form of a hollow sleeve *I* (Fig. 2) seated directly on the top of the transfer valve *T*. The back of the transfer valve is provided with greatly enlarged radiating and cooling surfaces presented to this cooling air and powerful convection currents are constantly acting when sealed. Moreover, this air when entering is at high velocity and gushes down through and bathes the deeply serrated surfaces of the back of the transfer valve, licking up the heat very completely in its inward rush.

Intensive Cooling Effective

Now in following out the cycle, it will be noticed that this is the very step that follows directly on the heels of the transfer of the hot gases and continues throughout the next quarter cycle and through the entire descent of the high-pressure piston, which in this way delivers a real power stroke to the crank with mean effectives in some instances greater than the mean effective pressures of the ordinary Diesel, thus returning some of the power taken to drive the supercharger or first stage pump. If the transfer valve is intensely heated on its under surface (see *T*, Fig. 2) and is then instantly intensely cooled on a surface five times as great, it will certainly strike and maintain a heat balance which in practice is found to be extremely low, only about one-half the temperature of the Liberty valves, nowhere nearly approaching red heat nor the temperature of normal Diesel exhaust valves under load conditions. Here is the crux of successful compounding, the great obstacle which has always been looked upon as practically insurmountable, solved by an extremely simple and straightforward method. In fact, the temperatures of the valve are lower than the calculated temperature balance because of the high velocity of the induction gases from the receiver.

Again, the heat in these gases absorbed from the hot valve is useful inasmuch as it is the auto-ignition temperatures as well as pressures that are required at the end of the compression curve. Here a useful heat transfer and pure regenerative process is carried out. The seats give no trouble because they are backed by the ample water jackets and, in fact, the whole transfer valve gear operates continuously and successfully and is found to be in perfect condition after hundreds and even thousands of hours of operation. They require practically no attention and are seldom ground in. This is exactly as it should be, considering the very low temperatures at which this valve really operates.

How Lightness Is Obtained

The question often asked is, to just what is due the smallness and lightness of the compound engine? It is this: In the four-cycle Diesel we have the tonnage of metal due to the presence of high pressures, operating at a ridiculously low material efficiency because these high pressures persist only about 2½ percent of the total time. The Diesel card rises abruptly and immediately falls. All the rest of the time, over 95 percent, either low pressures or no pressures at all are present, whereas in the compound the pressures *persist* and we are dealing with great blocks of power. Although the pressures are not materially higher than in Diesel

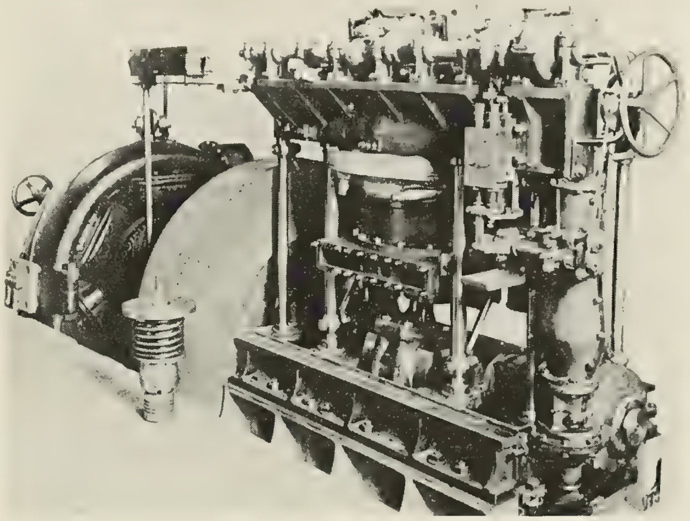


Fig. 1.—Marine Compound Oil Engine Built for Heavy Duty

practice, they are made to persist practically clear across the card, producing very large gross mean effectives. This is instantly followed by another line clear across the card, again producing another large gross mean effective in the low-pressure cylinder when referred to the high-pressure area, all from a single fuel injection. Instead of 60 to 70 pounds net mean effective to the crank, delivering its power through a few degrees only of one stroke in four, in the compound we have two net mean effectives, each of 300 or 400 pounds per square inch, succeeding each other and covering two strokes out of the four from a single fuel injection, giving very much better crank-effort distribution for power purposes.

The point of paramount interest is that these two large blocks of power are secured *not by any material increase of pressures*, but by using large quantities of power gases, and "hanging on" to the pressures we have in those gases throughout practically two complete strokes, clear across the card twice, thus abstracting much more of the power they contain before exhausting. Suppose these to be 330 pounds per square inch each. Added they make 660, which is easily ten times 62 pounds, a net mean effective not infrequently met with in ordinary Diesels. In an engine of simple construction giving ten times the net mean effective to its crankshaft and well distributed, there should be no good reason why it should weigh more than one-tenth the weight of the present Diesel.

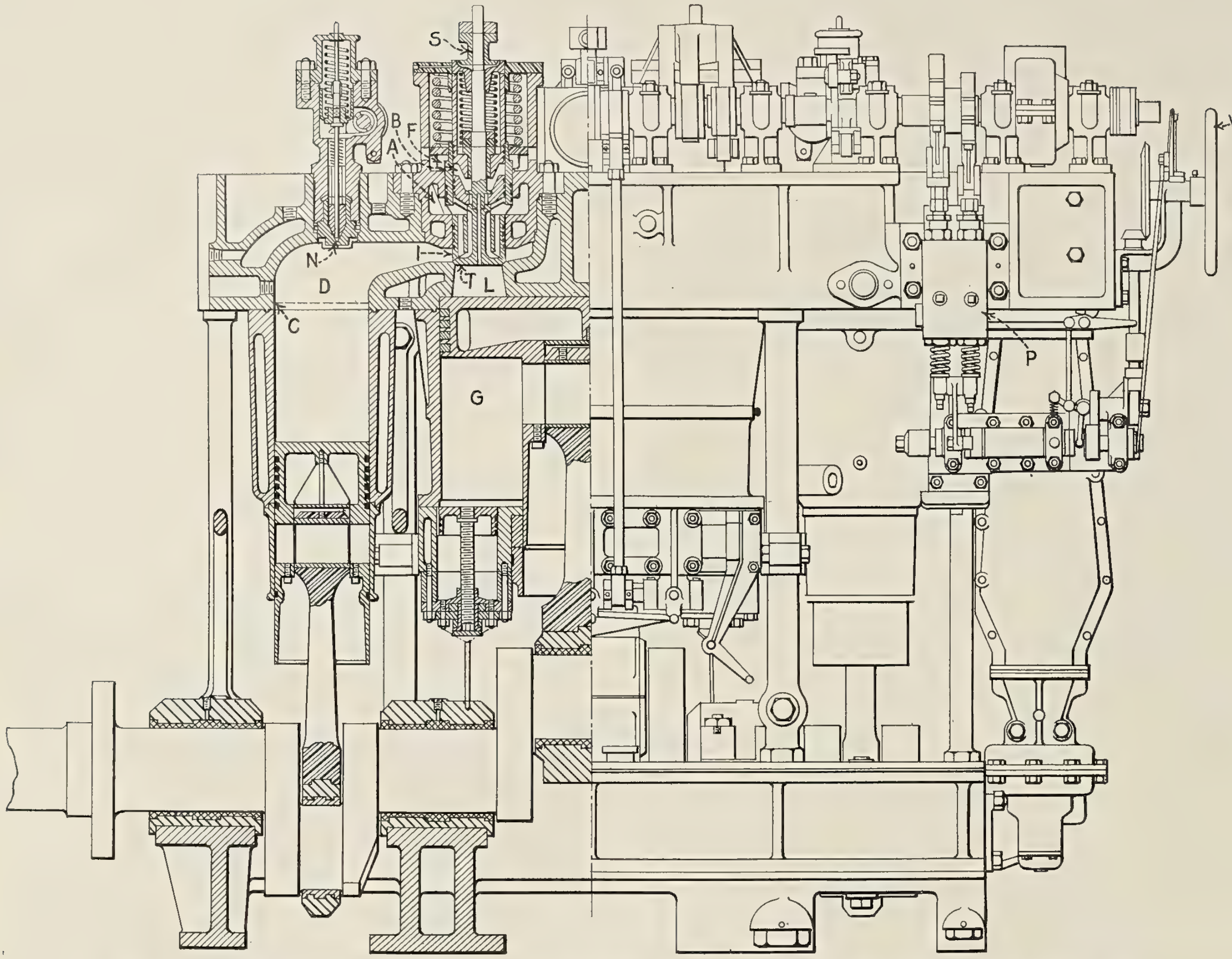


Fig. 2.—Longitudinal Section and Elevation of Sperry 10:1 Compound Engine Built for Heavy Duty

The power gases work in the Diesel about 120 degrees of arc and in the compound 315 degrees, or 2.6 times as long; or, considering the points of "cut-off" in each, the true expansion curve is 3⅓ times as long, which accounts for its large mean effectives and higher economies.

Proper Ratio for Compounds

As to the proper ratio for compounds; engines of 10:1 ratio of low-pressure to high-pressure cylinder areas, also 8:1 and 6:1 have been made, operated and studied, the smaller ratios being at present considered more desirable. The weight factor does not change materially with changes in ratio in this region. The low-pressure piston operates two cycle. The power distribution and the weight of the reciprocating parts both equalize best at about 6:1. This makes a perfectly balanced unit, the end masses equaling and also moving oppositely to the central. The two full power impulses following each fuel injection are also about equal. Thus full *four-cylinder performance* is secured with only three cranks and two extra power impulses are delivered on the induction stroke, making six power impulses for each cycle.

Another unusual advance should be noted, viz., complete reversibility and self air starting are secured without additional valves or cams over the simple, one way engine without air starting, there being no difference in this regard. Again comparing the full-reversing, air-starting compound unit with a similar four-cylinder Diesel of any prominent make, delivering the same number of primary power impulses to the crank, the latter has 16 valves and 32 cams. The former operates the same cycle with two extra power impulses over the Diesel with 5 cams driving 7 valves.

Three-Stage Compressor Eliminated

Doing away with the three-stage air injection pump, its intercoolers and general complexity, is another important simplification. One United States builder stated recently that an excess of 11 percent of the entire power of the engine is absorbed for driving these pumps.

As stated, solid injection only is used in the compound and the engine is controlled entirely by the fuel, viz., by lifting and timing the fuel valves. The constant-pressure trunk system is used with an accumulator in the line, the pumps simply working constantly against loaded relief valves which may be adjusted at will. Two very small plungers are constantly acting. The pistons, accumulator and the fuel valve stems are ground in and require no packing.

Types of Compound Engines

Fig. 1 shows a 10:1 compound engine, built for heavy duty. Although this is a small marine type with high-pressure cylinders 7-inch by 11-inch running at 400 revolutions per minute yet the size of the crank pitman-end in the lower center of the engine reveals the ruggedness of these parts. The fuel pumps are also shown here and the connection to the governor. The camshaft is on a shelf at the top of the engine to one side and is driven by skew gears. The electric generator forming the full load of this engine is shown in the background and one of the transfer valves with its bonnet cover stands on the floor in front of the

engine. The comparatively small size of the engine, although in the foreground, is notable. The compound works at a piston speed of about 700 feet per minute and its generator would be still smaller in comparison, should it be worked at the piston speed of about 900 feet per minute of the large engine.

The large size and weight in the Diesels extend to all makes in somewhat different degrees. A line of Diesels made in the United States is reported to weigh 512 pounds per brake horsepower, while the compound in Fig. 1 weighs less than 30 pounds per brake horsepower.

Internal Construction of the Compound

Fig. 2 shows an elevation to the right of the center, and longitudinal section to the left, of the engine shown in Fig. 1. The two high-pressure or combustion pistons on their out stroke are at the ends, and in the center is the low-pressure at its extreme in stroke. The sturdy construction is indicated by the size of the crankshaft, about 50 percent larger than in any other combustion engine of which the author has knowledge, approaching, as it does, the bore of the combustion cylinders themselves. The fuel pumps *P* and the control and manipulating wheel *W* are shown in elevation to the right. To the left the large dome of clearance *D*, forming the combustion chamber of the compound, stands out in marked contrast to standard Diesel practice, which is shown by the little space *C* between the solid horizontal line at the base of the clearance and the dotted horizontal line just above. The dome is large and forms an upward extension of the combustion cylinder, extending also to the right in a large sweep surrounding the transfer valve *T* which seals the transfer port *L*. The sleeve-like induction valve *I* is shown seated on top of the transfer valve and is controlled by the cam-operated fork *F*. The transfer valve and sleeve are lifted by a fork not shown, located in thimble *S* near the top of the stem. The first-stage annular compression pump *G* surrounding the trunk piston below the low-pressure piston proper, delivers its air to a small receiver, which in turn discharges to the cored port *A* surrounding the induction sleeve *I*, the cooling action of which has been described. The little balancing cylinder *B* sustains a permanent connection with the low-pressure cylinder. The solid-fuel injection valve and nozzle *N* are placed approximately over the center of gravity of the large masses of air in the clearance dome *D*.

It is understood that the two high-pressure cylinders are operating four cycle, one 360 degrees back of the other, discharging alternately into the low-pressure, which therefore works two cycle and delivers power on each down stroke.

Ordinary Standard Construction and High Mechanical Efficiency

The illustrations show the simplicity of the details, there being no part with which the ordinary engine builder is not perfectly familiar, nothing about the cylinders, pistons, rings or valves that lies outside ordinary good engine practice and construction. The radiating fins on the valves and the piston clearances and tolerances are the only points that vary to some small degree from the best Diesel practice.

A point of interest arises regarding the mechanical efficiencies of the compound. The two high-pressure cylinders in this case might be considered as constituting a two-cylinder Diesel. By separating them and adding one crank and the low-pressure piston between them, an increase of no less than seven times the power to the crankshaft is realized in this engine. Pursuing this one step farther, to obtain this increase of power at the shaft, it is perfectly apparent that we have not added, nor are we driving, seven times the machinery. We are driving probably about twice the machinery, giving one apparent reason for the very high mechanical efficiency observed in this engine. These efficiencies have again secured an additional check by motoring the engine and taking a number of sets of cards, in several instances indicating as high as 93 percent mechanical efficiency.

Port Velocities

In Fig. 2 the transfer port *L* to the low-pressure piston has only about one twenty-fourth of the area of the piston. The question naturally arises, what about wiredrawing through this port? This has been closely investigated and it is found that at 1,000 feet per minute piston speed, the velocities rise to 200 feet per second only at a point near the greatest velocity of piston travel. This comes from the fact that by the time the center of the stroke is reached, where the velocities are highest, the expanding gases delivering the power find themselves very largely on the low-pressure side and therefore are not required to traverse the port. It is well known that no wiredrawing, as such, exists at the velocities named.

Field of Usefulness of the New Prime Mover

To engineers versed in the problems of selecting and designing prime movers, the advantages of the compound combustion engine are readily apparent. Its light weight for a given power with resulting low first cost and capital charge, the low costs for foundations, the high speeds with consequent low costs for connected generators, the small space required and the simplicity and economy of operation are important reasons for suggesting new fields for this prime mover, which has been proven of practical value in a long series of tests under working conditions.

In connection with the development of the compound engine for marine purposes, and in order to provide any Diesel type of engine with speed flexibility equaling the reciprocating steam engine, there has been developed an electromagnetic clutch operating on an entirely new principle.* This clutch furnishes a positive yet completely elastic drive brought about by a unique correlation of two oppositely applied forces, each producing powerful torques induced and brought under perfect control by the application of a very small amount of external electrical energy. The drive has no moving parts, and is rugged and simple in design and construction. It is small for its power and therefore capable of being built in practically any range of horsepower.

Conclusion

In combustion engines the high-pressure principle is scientifically correct, having brought to the prime mover its choicest heritage, as stated, viz., the highest thermodynamic efficiency known. Broadly speaking, however, these various engines represent only the early stages of the development. The best of present embodiments in simple Diesels, though much refined as to certain details, are, generally speaking, extremely crude, their design is based on such a ridiculously small quantity of air per charge, and their material efficiency is too low to be tolerated. Further, very large structures are required to produce small powers.

This paper presents the results of research extending over a series of years, looking to the correction of these and other serious faults and to very greatly increasing the material efficiency. This is found to bring with it a number of distinct advantages and, it is believed, marks a definite advance. It is high time that this next logical step be taken so that the full capabilities of the high-pressure principle in combustion engines may be realized in service by the adoption of modern multi-stage methods. It is believed that the results for the first time announced in this paper warrant the prediction that engines employing the multi-stage or compound principle will occupy a dignified place in the combustion-engine art. If this principle should assume leadership, it will of course only be because of its demonstrated practical usefulness and general merit.

*For description see MARINE ENGINEERING AND SHIPPING AGE, November, 1921, page 817.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Marine Engineering Problems

Q.(1138).—(1) In putting hydrostatic pressure on steam boilers where the capacity of the pump and steam supply is limited, how do I find the amount of power lost through friction? We often have a pump that fails to put the pressure required on boilers for test, but we are unable to figure the size of the pump to install for this work of overcoming friction losses.

(2) Suppose the coils of a fuel oil heater are full of oil at 80 degrees Fahrenheit, and all valves shut to prevent escape of oil and steam is turned in the heater to heat the oil up to 250 degrees Fahrenheit, what will be the pressure in the coils? Please give me the formula for working this problem at various pressures and temperatures.

(3) Please name the strakes of steel or iron vessels and state where they are located.

(4) What should be the thickness of the lead sleeve in the stern tube of a wooden tugboat, and how is it made and put into place?

(5) What effect on the valve gear would be caused by moving the eccentric ⅛-inch forward on a shaft of 16 inches diameter? I want a formula for working these problems for various movements of eccentric and different sizes of shaft.

(6) What is the greatest wear down of tail shaft allowed by the United States Steamboat Inspection service and American Bureau of Shipping?

A. (1138).—(1) The writer knows of no way to figure the amount of power lost in a steam reciprocating pump through friction, but would suggest that on a basis of the test pressure and plant boiler steam pressure being equal, the steam piston area should be at least 30 percent greater than that of the water piston. This allowance takes care of not only the mechanical loss in the pump but for pressure drops due to leakage by pistons, valves and joints. The following general formula should give satisfactory results:

$$D = \sqrt{\frac{1.3\,d^2\,p}{P}}$$

where:

- p = test pressure to be placed on boiler, pounds per square inch.
- P = steam pressure on plant boiler, pounds per square inch.
- d = diameter of pump water cylinder in inches.
- D = diameter of pump steam cylinder in inches.

(2) This problem does not lend itself readily to solution by formula due to the uncertain conditions which enter into it. The only reliable method would be by actual test, reading the resulting pressure from a calibrated pressure gage.

(3) On a typical shell expansion or midship section the various strakes of plating are designated by letters, beginning at the garboard strake and lettering out around the bilge and up the side, ending with the sheer strake, thus A, B, C, etc. The letter I is generally omitted to avoid confusion. The flat keel strake, or plate, is marked F. K.

In addition to the designations just noted, some strakes are known by names which, by reason of long association with certain portions of the vessel, identify the strake immediately with those portions. The principal among the strakes so named follow together with a description of each.

Flat plate keel, a series of plates of extra thickness which forms the strake running fore and aft along the vessel's bottom at the center line.

Sheer strake, the strake of shell plating that runs along the level of the main or upper decks. Plates running along the level of the lower decks are not called sheer strakes. See "Shipbuilding Cyclopedia," page 121.

The keel and sheer strakes are important strength members because of their distance from the neutral axis of the ship. They are generally made thicker than the other strakes of side or bottom plating.

Bilge strake, a strake of outside plating running along the bilge.

Bottom strake, a strake of bottom plating lying between the garboard and bilge strakes.

Garboard strake, the strake of bottom plating adjacent to the keel. The garboard strakes are frequently made heavier than the other bottom strakes as they work closely with the keel to form the backbone of the vessel.

Topside strake, the strake next below the sheer strake.

There are other strakes which are named because of certain outstanding features or certain work done.

Doubling strake, a strake of plating fitted in conjunction with a regular strake. The sheer strake and keel are frequently doubled to provide extra strength.

Drop strake, a strake which is terminated short of the bow or stern due to the decreasing girth of the ship as the ends are approached.

Inner strake, a strake adjacent to the molded frame line.

Outside strake, a strake which laps onto the two adjacent inner strakes.

The last two terms apply to the so-called "in and out" system of plating.

(4) The dimensions of the lead stern tube are, of course, dependent upon the size of the vessel. In a wooden tug of 88 feet overall length, a hole or shaft well 8½ inches in diameter was driven through the shaft log. This was fitted with a lead sleeve or lining ¼ inch in thickness. The lead tube itself was in one piece fitted singly between the two portions of the shaft log. At its forward and after end it was expanded over the stuffing box and stern bearing, respectively.

In a smaller, higher speed boat with which the writer is familiar the bore of the shaft log is 4½ inches and the thickness of lead sleeve ⅛ inch.

(5) The following conditions are assumed:

(*a*) The piston for the cylinder in question is at the bottom of its stroke.

(*b*) The crank turns anti-clockwise when standing at the forward end of the engine looking aft.

(*c*) Steam taken over ends of valve.

(*d*) Engine has open rods, i. e., with the piston in position (*a*) the center of the ahead eccentric would be to the right of the engine vertical center line and above the horizontal shaft center line at a distance equal to the angle of advance.

(*e*) The eccentricity, or half the valve travel, equals 5 inches.

(*f*) The angle of advance or the angular distance which the center of the ahead eccentric is above the horizontal shaft center line.

(*g*) L = length of eccentric rod, i. e., center of eccentric to center of link block pin, equals 96 inches.

r = eccentricity = 5 inches.
R = half the shaft diameter (given) = 8 inches.
m = lineal movement along shaft (given) = ⅛ inch. This movement is to be forward, i. e., in the direction the shaft rotates.
ϕ = 40 degrees.
$\triangle$ = angular movement of eccentric around shaft in degrees corresponding to "m" =

$$\frac{360\,m}{2\,\pi R} = \frac{360 \times .125}{2 \times 3.1416 \times 8} = .895 \text{ degree}$$

$= 53.7$ minutes.

θ = new angle of advance = $\phi + \triangle$ = 40 degrees + 53.7 minutes.
a = vertical distance from horizontal center line of shaft to center of eccentric before movement = $r \sin \phi = 5 \times .6428 = 3.214$ inches.
a_1 = vertical distance from horizontal center line of shaft to new center of eccentric after movement = $r \sin \theta = 5 \times .6546 = 3.273$ inches.
b = horizontal distance from the vertical center line of engine to the center of the eccentric before movement = $\sqrt{r^2 - a^2} = \sqrt{(5)^2 - (3.214)^2}$ = 3.831 inches.
b_1 = horizontal distance from the vertical center line of engine to the new center of the eccentric after movement = $\sqrt{r^2 - a_1^2} = \sqrt{(5)^2 - (3.273)^2}$ = 3.78 inches.
l = vertical distance from the center of the eccentric, before movement, to center of link block pin = $\sqrt{L^2 - b^2} = \sqrt{(96)^2 - (3.831)^2} = 95.9235$ inches.
l_1 = vertical distance from new center of eccentric, after movement, to center of link block pin = $\sqrt{L^2 - b_1^2} = \sqrt{(96)^2 - (3.78)^2} = 95.9256$ inches.
d = distance which link block pin has been raised by moving the eccentric forward ⅛ inch around the surface of the shaft = $(a_1 + l_1) - (a + l)$ = $(3.273 + 95.9256) - (3.214 + 95.9235)$ = .0611 inch = 1/16 inch approximately.

This dimension "d" is also the amount which the valve is raised or, in other words, it is the amount by which the bottom steam lead would be increased. The top lead would, of course, be increased by the same amount and cut-off, admission, compression and release will all occur earlier in the stroke of the piston as a result. Had the shifting of the eccentric been in the opposite direction, the bottom steam lead would have been decreased and all events would have occurred later in the stroke.

By using the above method of procedure, the amount by which the steam lead is affected may be calculated for any movement of the eccentric on its shaft, for any diameter of shaft or throw of eccentric.

(6) There is no express rule under the Steamboat Inspection Service as to the percentage of wear down on a tail shaft. The local inspectors having original jurisdiction use their best judgment, based on practical experience.

The American Bureau of Shipping, see section 45 of the rules, provides as follows:

"Tail shafts are to be drawn for examination at least once every two years, but when liners are fitted solid in one length, the shafts need only be drawn once every three years.

"When the after bearing is worn down ¼ inch with shafts not exceeding 9 inches in diameter; 5/16 inch when over 9 inches and not exceeding 12 inches and ⅜ inch with shafts over 12 inches in diameter, the bearing is to be rebushed."

Horsepower of Multiple Cylinder Engines

Q. (1141).—Will you give some information in regard to figuring the indicated horsepower of triple expansion engines of three and four cylinders and quadruple engines, with regard to vacuum and back pressure. I refer to the difference that these will make to the mean effective pressure that is obtained from the indicator diagrams.

A. (1141).—"The term 'back pressure' is usually applied to the pressure of the exhaust from the low-pressure cylinder, although of course there is back pressure in the other cylinders due to the exhausting of the steam into the next cylinder. It is of importance to keep the back pressure in the low-pressure cylinder as low as possible, as this pressure acts on the piston in opposition to the steam pressure. In order to keep the back pressure low, care should be taken in the design of the low-pressure cylinder to make the exhaust passages and exhaust pipes of ample area and free from obstructions and abrupt turns. The back pressure in a well designed low pressure cylinder should not exceed 3 to 4 pounds absolute. It may be found from the indicator card and is usually 2 pounds more than the pressure in the condenser as shown by the vacuum gage." For the foregoing, see page 826, "Marine Engineer's Handbook," by Sterling.

Considerable attention has been paid during recent years to the design of condensing apparatus having high vacua. Bragg in "Design of Marine Engines and Auxiliaries," page 13, writes: "The effect of vacuum upon economy was investigated in certain experiments carried out by Professor Weighton. He found that the number of pounds of steam per brake horsepower was least at a vacuum of 26 to 28 inches, but that the number of heat units, working from the high pressure steam chest to the hot well per brake horsepower was least at 20 inches vacuum. While the horsepower of the engine is increased by increasing the vacuum, it causes the temperature of the hot well to be lower, and it is possible to carry the cooling to such a point that the coal per brake horsepower is increased.

"Another point brought out by these experiments was that in going from 26 inches vacuum to 28 inches vacuum, the mean referred pressure was not increased by the equivalent of 2 inches of mercury but by something less than 2 inches.

"It was also shown that the effect of increased vacuum was not confined entirely to the low pressure cylinder but reached back into the intermediate and high pressure cylinders with the result that the steam consumption instead of remaining constant per revolution increased as the vacuum increased. Both of these results are probably due to the increased range of temperature in the cylinders, causing an increase in the initial condensation. This effect would probably be greater with less stages of expansion and less with a greater number of stages."

In determining the size of a multiple cylinder engine to develop a given horsepower the size of the low pressure cylinder is first ascertained and the other characteristics fixed with this as a starting point. The "mean effective pressure" is the mean pressure of admission and expansion as derived from the indicator card or the total area of the indicator card divided by the length of stroke. The "mean referred pressure" is the mean effective pressure that would be necessary to do the combined work of all the cylinders in the low pressure cylinder alone. In the actual indicator card or diagram the lower boundary of the figure is termed the "back pressure line." The closer that this line can be brought to the zero line representing perfect vacuum the greater the area of the card and the higher the value of the mean referred pressure. A small reduction in back pressure produces an effect upon engine efficiency equal to that of a much larger increase in initial pressure. In the case of a 5,000 indicated horsepower three-cylinder triple expansion engine, the change of back pressure by one pound effected a reduction of 1 inch in the diameter of the 94-inch low pressure cylinder.

PERSONAL MENTION

Lawrence J. Brengle was appointed acting manager of the United States Salvage Association at a meeting of the directors on December 15. Mr. Brengle succeeds Charles R. Page, whose resignation took effect December 31, when he became manager of the Atlantic marine department of the Firemen's Fund Insurance Company. Mr. Brengle was formerly the underwriter of Syndicates "B" and "C" of the American Marine Insurance Syndicates in which capacity he will continue, devoting sufficient time, however, to the supervision of the administration of Syndicate "A" and of its operating agent, the United States Salvage Association, Inc. Mr. Brengle has had wide experience in the handling of the affairs of wrecked and damaged vessels and is familiar with shipping of the Pacific as well as the Atlantic coast, which fits him particularly to administer the affairs of the Salvage Association.

John H. Trowbridge, formerly with the firm of Marsh & McLennan and recently chief clerk of the American Marine Insurance Syndicates, will have direct supervision of the administration of the affairs of the United States Salvage Association, Inc., under Lawrence J. Brengle, acting manager of the association.

Thomas L. Clear, whose appointment as treasurer of the United States Shipping Board Emergency Fleet Corporation was announced in the November issue of Marine Engineering and Shipping Age (page 860), received his early training in banking and railway service. He was an assistant to General Goethals in 1908, having been appointed assistant auditor to reorganize the fiscal operations of the Panama Canal and Panama Railroad Company. In 1914 he was appointed by General Goethals as collector of the canal and later became treasurer of the Panama Railroad Company. While collector, Mr. Clear organized a plan by which ship operators were able to have ship charges paid by their local banks wherever located to a correspondent bank at the canal, greatly facilitating the movement of vessels. The system which now prevails enables an operator at any part of the world to pass his ship through the canal without any deposit and, unless the ship is in need of fuel or repairs, she is not required to stop in approaching and passing through the canal except when in the locks. Mr. Clear left the canal in the summer of 1918 and was sent to Europe by the War Department in the capacity of an inspector general, his work being confined to the supervision of financial affairs of the American Expeditionary Forces. He returned to the United States in September, 1919, and was appointed comptroller of the United States Shipping Board by Judge John Barton Payne, its chairman, but declined the appointment and, at the request of Governor Harding, returned to the Panama Canal and resumed his former position. After fifteen months' service he accepted an appointment in the United States Army as an inspector general, but resigned his commission October 7 to become treasurer of the United States Shipping Board Emergency Fleet Corporation.

Major T. L. Clear

G. O. MacConachie, in addition to his duties as assistant to Joseph W. Powell, president of the United States Shipping Board Emergency Fleet Corporation, has recently been given entire supervision of the personnel of the corporation. He was born in Detroit, Mich., and received his education at the Central High School of that city and at the University of Michigan. In 1919, he entered newspaper work and served on the staffs of various Detroit newspapers until 1914 when he entered the employ of the Campbell-Ewald Company, advertising agents. In 1917 he joined the Harlan plant at Wilmington, Del., of the Bethlehem Shipbuilding Corporation and was appointed head of the service department. During the three and a half years he was with this corporation, he supervised the general publicity work at Sparrows Point, Md., at the Harlan plant, at the Moore plant, Elizabeth, N. J., and at the Fore River plant, Quincy, Mass.

G. O. MacConachie

Charles Kerr, formerly with the Bethlehem Shipbuilding Company, has been appointed outside marine superintendent for the Main Iron Works, San Francisco, Cal.

C. A. Askew, vice-president and general manager of the Atlantic Gulf and Pacific Steamship Company, will have charge of the office affairs on the Pacific coast, succeeding Thomas J. Wade, who recently resigned.

A. P. Hammond, who has been Pacific coast manager of the Luckenbach Steamship Company for five years, recently resigned. Lewis Luckenbach will handle the affairs of the company on the Pacific coast for the present.

C. L. Christenson, for the past five years connected with the New York offices of the International Mercantile Marine Company, has been appointed manager of the Cleveland passenger office of this company which has recently been opened.

J. V. C. Comfort has been appointed manager of the Pacific Mail Steamship Company's Panama Line, according to an announcement made by Thomas Graham, vice-president and general manager. Mr. Comfort is succeeded as operating manager by Thomas James. Both these men have been with the Pacific Mail Steamship Company for many years.

Commander L. M. Stewart has been appointed successor to William Glassford in charge of the United States Naval Hydrographic office with headquarters in the Merchants Exchange Building, San Francisco, Cal. For the past few months Commander Stewart has been in charge of the eleventh destroyer division at San Diego; before this time he was captain of the destroyer *Yarnall* with the Asiatic Squadron. During the war he commanded the destroyer *MacKall* and was also in charge of the mine assembling base at Inverness on the coast of Scotland.

Shipping and Ship Operation News

Changes in Steamship Routes — Passenger and Freight Activities—Port Plans and Other Notes of General Interest

Chartering of Tankers Profitable To Shipping Board; Bare Boat Plan Returns $50,000 a Month Revenue

J. Barstow Smull, Vice-President of Emergency Fleet Corporation, Reports on Six Months' Activities—Losses in Voyage Operations Being Steadily Diminished

J. BARSTOW SMULL, vice-president of the United States Shipping Board Emergency Fleet Corporation, in charge of allocations and charters, has issued the following statement regarding the work accomplished in his division in the past six months:

"I found on assuming my office in July that there was no one in the whole organization who knew anything about chartering. Charters were being put through that were absolutely detrimental to the Board's interests. I selected the best man I could find in the chartering trade to take over this most important work and stationed him in New York. Since then we really have had few slip-ups whereby the Board suffered.

"The chartering of tank boats has been very profitable and is still going on today. Of course, the general trades have been so poor that it has not paid to charter vessels and I have not chartered any vessel for general cargo business.

"We have been struggling hard with the bare boat charter as the times have been against us, but we are most pleased to say that we have twenty-three (23) vessels under bare boat charter which turn in a revenue of about $50,000 a month. With an improvement in the freight market at all, undoubtedly we will have the opportunity of putting forward quite a few boats on time charter basis."

Discussing the charter situation on the Atlantic Coast, Mr. Smull continued:

"Some time ago the Board of Trustees decided that it was not fair to privately owned tonnage on our Atlantic Coast to charter our vessels on a bare boat basis to compete against established lines in the coastwise trade. There is no doubt that a ship on a bare boat charter at 50 cents a ton can very successfully compete with privately owned tonnage bought at high prices, for the private owner has to take into consideration in making his rates, his overhead expenses, his depreciation, interest on his money and Marine Insurance.

"We are mandated by the Jones Bill not to interfere with privately owned established trades, and in following out the requirements of the Merchant Marine Act it is necessary for us to refrain from chartering our vessels on any sort of a time charter basis where they would be thrown in competition with those vessels privately owned."

The vice-president then briefly reviewed the activities of the Contract Department in his division:

"This department has charge of the working out of all charter parties and contracts effected on Shipping Board tonnage.

"It might be interesting to the public to know that since the Board has been in office we have been able to collect more than $178,000 in demurrage. Formerly these demurrage claims either laid dormant or were put into the hands of the legal department, where it would take anywhere from three to five years to get them tried out in the courts.

"We have been able to settle these cases either by mutual agreement or by arbitration. My department at present has under active negotiation for settlement more than $300,000 worth of these claims. Altogether there seems to be about $2,000,000 of these demurrage claims against American shippers, and about $3,000,000 against foreign governments which will have our attention in due course."

Regarding withdrawals and allocations, Mr. Smull said:

"On July 24 there were 75 active managing agents of the Fleet Corporation operating 674 steel ships. Of this number of agents there were 12 acting as tramp operators, having a total of 125 vessels in service. The losses were running from $5,000 to $25,000 per round trip voyage to Europe, approximately $1,250,000 being the loss in voyage operations last June.

"On January 1, 1922, there will only be 43 active agents handling 321 ships. All tramp steamers have been withdrawn. The losses in voyage operations in October, which is the last month for which we have a report, had been cut to $400,000, and they are still being diminished.

"From July 20 to the present date 526 steel cargo carriers have been withdrawn from service, and 173 are allocated as follows: Eighty for berth service, 13 for bulk cargoes, and 80 as substitutes for the betterment of services and the saving of repairs. This leaves a net number of 353 steel cargo and passenger vessels that were tied up from July 20 to date."

FREIGHTER POPULAR

West Lewark Clips 11 Days from Foreign Voyage Schedule

When the *West Lewark* was delivered to the United States Shipping Board by her builders, the Los Angeles Shipbuilding & Dry Dock Company, last July, and was chartered by Williams Dimond & Company for Pacific-European trade, she attracted considerable attention at northern ports because of her being the first Pacific coast built vessel of her type and one likely to prove particularly popular with shippers.

The *West Lewark* left the west coast at the end of August with full cargo for Glasgow, Liverpool, London, Antwerp, Rotterdam and other ports. According to the schedule laid out for her she should have returned to Los Angeles harbor November 14. She reached here, however, Friday, November 11, and by Saturday, November 12, she had unloaded her cargo at this port and had again cleared for northern ports. Not only this, but while in Europe she had been diverted to Liverpool for return cargo, thus taking up eight days not allowed for her schedule. Captain Ansell, therefore, claims to have clipped his schedule eleven days and to have brought his ship back after traveling 20,000 miles without a stop, and in that perfect condition which reflects the utmost credit upon the port of her registry and the work of the organization that built her.

With full cargo the *West Lewark* averaged 11.95 miles per hour in the run from Cristobal to Glasgow. Her revolutions were 75.6, and her average oil consumption was .99 barrels per mile.

World's Largest Steamship to Sail from New York on May 20

Following the return from abroad of P. A. S. Franklin, president of the International Mercantile Marine Company, the White Star Line has announced that the 35,000 ton *Homeric* will make her first return voyage from New York on March 1, 1922, and that the 56,000 ton *Majestic*, the world's largest steamship, will make her first voyage out of New York on May 20. These two steamers, with the *Olympic*, will maintain a regular weekly service between New York and Southampton via Cherbourg.

The addition of the *Majestic* and *Homeric* to the Southampton service releases the *Adriatic* for the New York-Liverpool service, where she will operate with the *Celtic*, *Cedric* and *Baltic* in a regular weekly schedule. These four steamers, in addition to passenger accommodations, have an unusually large cargo capacity.

Plans Maturing for New Direct Steamship Line Between the Hawaiian Islands and Los Angeles, Cal.

Steamers Aeolus and Huron Allocated to Los Angeles Steamship Company for Expansion of Service to Include Passenger and Freight Route to the Islands

PLANS for the establishment of a direct steamship line between the Hawaiian Islands and Los Angeles have been under development for several weeks past. Announcement of these plans was made following the launching, at the plant of the Los Angeles Shipbuilding & Dry Dock Company, of the *West Chopaka,* 35th and last steel freighter built by this concern for the United States Shipping Board and now under charter to Struthers & Barry.

Following the launching of the *West Chopaka,* Fred L. Baker and Erle M. Leaf, respectively president and vice-president of the shipbuilding company, entertained some three hundred guests on the steamship *Harvard,* taking them over to Catalina. Among the guests were men representing most of the important civic and business interests of Los Angeles. At a meeting held in the smoking room of the *Harvard* the plan to expand the interests of the Los Angeles Steamship Company and include a high class freight and passenger service with the Hawaiian Islands was fully discussed. Shortly after this meeting Mr. Leaf went east, and placed before the Shipping Board and administration officials the definite plans of his associates, requesting the allocation by the United States Shipping Board of two ex-German liners.

December 1st, despatches from Washington announced the success of Mr. Leaf's errand and the allocation to the Los Angeles Steamship Company of the *Aeolus* and *Huron,* now being operated by the Munson Line on the South American run, but shortly to be turned back to the Shipping Board and through them to be delivered to the Los Angeles people early in 1922.

The *Aeolus* and *Huron* are 15-knot, oil burning vessels, originally in the Atlantic service between Bremen and New York, and then known as the *Grosser Kurfurst* and the *Frederich der Grosse.*

The *Aeolus* is 560 feet long between perpendiculars, and the *Huron* is 528 feet. Each has capacity for about 400 passengers, and each is equipped with gyroscope, being therefore considered as exceptionally steady and claimed to be great favorites with the sea-going public.

Certain changes and improvements planned for these vessels by the Los Angeles Steamship Company will be made upon their arrival at Los Angeles harbor, but it is understood that having but recently been thoroughly re-conditioned, decorated and furnished, the contemplated re-equipment and alterations will not take long, so that the new service to Honolulu is expected to be started during the coming spring.

The importance of this service to the Hawaiian Islands and to the entire Los Angeles community cannot be well overestimated. A "home owned" line of ships, recognized as being of the very finest class, is of paramount importance to any port. It means business for the port out of all proportion to that which comes from vessels merely "calling" at the port. To the Hawaiian Islands it means greater benefits since this direct service will be of incalculable advantage in developing tourist travel as well as providing a sure and regular service for every day business between these two points. Instead of being, as it is today, mainly a point of call between California and the Orient, Honolulu will be a terminal port of regular service of the highest class with Los Angeles and that vast tourist travel which Southern California has built up.

In the course of his negotiations in the East, Mr. Leaf had the honor of an interview with President Harding, who expressed himself as being particularly interested in the development of plans which would further the interests of the Islands and place them in closer touch with the Pacific Coast.

"NO. 80" ENTERTAINS

Ocean Engineers Greet Santa Claus—President Martien Re-elected

A very successful Christmas smoker and general "get together" meeting of Ocean Marine Engineers Beneficial Association, No. 80, of New York city, was held in their club rooms at 15 Whitehall Street, on Tuesday night, December 20, 1921. The affair was formally opened by the introduction to the assembled members and their guests, which numbered about 450, of Mr. E. Martien, the president of the local. The introduction was made by Mr. B. L. Todd, better known among the boys as "our Bert," the business manager.

The entertainment consisted of many musical numbers rendered by accomplished musicians and fellow members, story telling by George Smith, several very good three-round bouts, a visit from Santa Claus and refreshments. The speaker of the evening was the Honorable Peter J. Brady, Commissioner of Records, of the city of New York, and an official of the Printers' Union, who gave a very interesting account of the trials that the several labor organizations had gone through during the past year of depression, but left all with the impression that the "worst was over."

Stephen J. Kelly, president of Allied Printers, State of New York, sang several ballads, and Mr. Todd announced that Mr. Martien had consented to be president for the coming year.

STEAMSHIP INTERESTS

According to officials of the Mallory Steamship Company, a new ten-day steamship service between Tampa and New York will be inaugurated with the sailing of the Mallory steamer *Altamaha.* The company proposes to use its own boats in this service and to release the boats of the Shipping Board which have been in use by the line since the war.

The Robert Dollar Steamship Company will inaugurate a freight service between Seattle, Vancouver, B. C., and San Francisco, on the Pacific Coast and ports of the Far East, on January 10, 1922, according to an announcement made public by officials of the company. The three ships to be used in this service are the *Harold Dollar, Bessie Dollar,* and *Melville Dollar.*

The tanker H. M. Storey has had its trial trip under the supervision of Captain Herbert Kirst, of the Bethlehem Shipbuilding Corporation, San Francisco, Cal. She is the second of three tankers to be completed by the Bethlehem Company for the Standard Oil Company. All three are of the same type and of 15,000 deadweight tons each, with a carrying capacity of 120,000 barrels of oil and a speed of 11 knots.

Following the disbanding of the firm of Struthers & Dixon, and the closing of their Seattle and San Francisco offices, C. S. Holmes, former resident agent for the firm at Seattle, has announced the formation of the C. S. Holmes Shipping Company of Seattle, with offices at 321 L. C. Smith Building, Seattle, Wash. The new firm will be agent at Seattle for the Intercoastal Sea Carriers, Inc.

It is announced that the State Railroad Commission, San Francisco, Cal., has authorized the Bay Transportation Company to issue not exceeding $127,500 of its common stock and to assume the payment of indebtedness amounting to $207,562.93. The Bay Transportation Company was recently organized for the purpose of taking over the business of E. V. Rideout & Company. The company operates steamers and barges in San Francisco Bay.

Indicative of better shipping activity at Philadelphia, it is announced that two new services will be established from the port of Philadelphia by the Hudson Shipping Company. The Export Steamship Corporation, 25 Broadway, New York, will inaugurate a line to Constantinople, Smyra, and Alexandria with the freight steamer *Blair,* and the Baltimore Steamship Company, Inc., will inaugurate the second service with the steamer *Coelleda.* Reductions in class and commodity rates between Norfolk and Boston and Providence have been put into effect by the Merchants & Miners Transportation Company. New rates on fruit and vegetables are from 5 to 10 per cent lower than those hitherto in force, and oyster rates are a little more than 5 per cent lower than formerly. Rates on northbound forest products, knit goods, and peanuts are also revised downward. Southbound rates on iron and steel products have been cut.

A reduction of $21.50 in third class passenger rates to Hamburg and $28.50 to

(*Continued on page* 74)

Shipbuilding and Terminal Development

What the Shipyards Are Doing—Dry Dock Notes—Launchings—New Engineering Projects

City Island, N. Y., Shipyard Gets Contract To Build Distinctive Type Of Houseboat Having Oil Engines

Plans and Specifications Prepared by Henry J. Gielow, New York Naval Architect, Provide for Capable Seagoing Craft Also Suitable for Florida Waters

AT the yard of Kyle & Purdy, City Island, N. Y., work has been commenced on the construction of a steel houseboat for Mr. Louis H. Eisenlohr, of Philadelphia, member of the Philadelphia, Corinthian and other eastern yacht clubs. Plans and specifications for this yacht were prepared by Henry J. Gielow, the veteran naval architect of this city, and will be a notable addition to the houseboat fleet. This craft will have the distinction of being one of the first houseboats equipped with heavy oil engines of the Diesel type.

The principal dimensions will be: Length over all 100 feet 9 inches; length on load water line 95 feet 3 inches; beam, moulded, 21 feet; and draught 4 feet 6 inches when fully loaded. The dimensions of this yacht have been determined with a view to securing a thoroughly sea-going vessel, and at the same time obtaining a craft well suited for cruising in the lagoons, streams and inland bays of Florida.

The hull will be constructed of mild steel, the side plating being carried up to the upper deck, with steel deck beams and diagonal strapping, thus securing a thoroughly substantial construction. Her lines will be the combined perfection of sea-going qualities with a minimum draught, and were it not for the rectangular windows, would show all the characteristics of a sea-going motor yacht. These windows, however, add so much to the owner's comforts, both as to light and ventilation, that it was considered best to use them instead of the much smaller, conventional circular air ports.

The deck house will be 44 feet long, with a mean width of 14 feet in the clear, constructed of mahogany panel work. In the forward end will be the dining room 15 feet 6 inches long by 14 feet wide, fitted with buffet and sideboard, china closet, serving tables, etc. The pantry has a floor space of 74 square feet, fitted with dressers, sink, dish racks, china closet; refrigerator and a dumbwaiter to galley below. Aft of dining room, on port side will be a lavatory, and opposite starboard side a cabinet with racks for guns, fishing tackle, ammunition and sporting supplies. Next will be the main saloon or social hall, 18 feet long in the clear and occupying the full width of the deck house, with stairway in the after end leading to staterooms below; among the furnishings will be a desk, book case, piano, divan, etc.

The owner's and guests' quarters will be in the after end of the vessel, and will occupy the entire width for a fore and aft distance of 38 feet. The owner's stateroom will be forward, and have a floor space of 200 square feet, fitted with brass bed, chiffonier, bureau, mirrors and large wardrobe. Forward of this stateroom will be a bath room, connected with the owner's stateroom. Aft of the owner's room will be four more staterooms and two more bathrooms, each stateroom furnished with bed, bureau, and wardrobe, and all bath rooms will have porcelain enameled lavatories, bath tubs, etc., with nickel-plated mountings, open plumbing, and tiled floors and walls.

The machinery space will come next and occupy the full width of the vessel for a distance of 18 feet fore and aft. Next forward comes the galley with a floor space of 130 square feet, fitted with range, dish racks, dressers, lockers, sinks, cold storage, etc.

Forward of this will be the officer's and crew's quarters, all designed on a liberal scale, occupying a floor space of 468 square feet; in fact, the aim in designing this vessel has been to secure fewer large roomy accommodations rather than a larger number of smaller, cramped ones. Liberal accommodations for storage of ice have been provided; but a mechanical refrigerator plant will also be installed. The interior finish will be white pine panel work finished in ivory white, with mahogany trim finished bright.

The propelling machinery will consist of two 120 H. P. six cylinder heavy oil engines of the Diesel type, which gives the vessel a speed of over 12 statute miles per hour. The oil tanks have a capacity of 3,400 gallons, which will give a cruising radius of 2,500 miles at full speed, which is unusually large for a vessel of this type. The propellers are to be of manganese bronze, especially designed for this vessel by Mr. Gielow.

Fresh water tanks are to be provided with ample capacity to last for a cruise of three thousand miles.

Motorship Missourian Launched at Chester, Pa., for American-Hawaiian Line

The 11,000 deadweight ton motor ship, *Missourian,* built for the American-Hawaiian Steamship Company, was successfully launched Wednesday, December 14, 1921, at the Merchant Shipbuilding Corporation's yard, Chester, Pa. This is the second twin screw motor ship, and all American product to be launched on the Delaware River.

The principal dimensions of the *Missourian* are as follows: Length overall, 461 feet; moulded beam, 59 feet 8 inches; moulded depth to shelter deck, 39 feet; cargo capacity, 560,000 cubic feet; contract speed, 11½ knots.

The propelling machinery consists of two Burmeister & Wain six-cylinder, single-acting, four-cycle Diesel engines of the cross-head type. Each engine is rated at 2,250 Diesel indicated horsepower.

Both main and auxiliary Diesel engine sets are nearing completion in the shops of William Cramp & Sons' Ship and Engine Building Company, Philadelphia.

Contract Awarded to George B. Spearin & Co. for New Pier at 44th Street, N. R.

The George B. Spearin & Company, Inc., 90 West Street, New York, with a price of $363,565, was awarded the contract for the construction of a new pier at 44th Street, North River, following the opening of tenders by the Department of Docks, Pier A, North River, New York, on Monday, December 12.

The present pier with its freight shed is to be entirely removed and also the bulkhead shed which extends across the inner end of the pier. The engineer's estimate of the amount of dredging to be done is about 5,400 cubic yards. The pier is to be supported on vertical piles and braced with inclined piles. The superstructure will consist of double rangers over the outer bay and of side and shed rangers, chocking, mooring posts, single bitts, fendering and fender piles, a concrete deck, except wooden decking over the outshore of bay. Four elevator pits are to be constructed and fire walls are to be built beneath the pier across its full width. For the work inshore of the bulkhead line the contract comprises all pier construction including retaining walls, pile and timber work, sheet piling, concrete foundations, concrete deck, etc. It is estimated that about 3,000 cubic yards of riprap will be used to secure greater stability around the piles.

The time allowed for completion is 275 days.

$43,000,000 Recommended For Government Port and River Work During Fiscal Year 1922-23

Substantial Sums Requested by Chief of Army Engineers for Development of Principal Harbors on Atlantic and Pacific Seaboards

MAJOR GENERAL BEACH, Chief of Army Engineers, in his annual report to the Secretary of War, Washington, D. C., recommends a total expenditure of approximately $43,000,000 for river and harbor improvements during the fiscal year 1922-23, exclusive of the proposed $7,500,000 project for Muscle Shoals, Ala. Among the principal harbor projects are the following:

New York, $2,900,000 including $2,200,000 for the East River and $350,000 for the Hudson River Channel; Philadelphia to the sea, $3,660,000 including $500,000 for Philadelphia Harbor and $1,500,000 for Liston Range; Savannah, Ga., $1,025,000; Norfolk, $500,000; Los Angeles, $300,000; Humbold, Cal., $400,000; and Grays Harbor and Bar Entrance, Wash., $660,000.

Principal river projects: Mississippi from the mouth of the Ohio to the mouth of the Missouri, $1,000,000; from the mouth of the Missouri to Minneapolis, $2,000,000; Southwest Pass, $1,136,000, and South Pass Channel, $250,000; Ohio for locks and dams, $5,000,000 and for general open channel work, $534,000; Allegheny Locks and dams, $900,000, and open channel work, $5,000; Detroit, $1,100,000; Illinois below Copreas Creek, $440,000; Columbia and lower Willamette below Vancouver and Portland, Ore., $850,000; Missouri, $145,000 including $25,000 from Kansas City to Sioux City and $20,000 from Sioux City to Fort Benton, Montana, and St. Marys River, Mich., $557,000.

Remarkable Feat Accomplished In Salvaging and Docking the 12,000 Ton Standard Oil Tanker F. D. Asche

ONE of the most remarkable salvage operations on record was performed when the *F. D. Asche*, a Standard Oil tanker, arrived in New York recently, after being towed all the way from the Bahamas with practically no bottom in her. The *Asche*, in command of Captain L. S. McKenzie, was caught in the cyclone that devastated Tampa, swept out of her course and piled up on Stranger Key reef. In the next twenty-four hours the *Asche* was carried one mile over the reefs where she remained fast.

The wrecking steamers *I. J. Merritt* and *Willard*, of the Merritt-Chapman Wrecking Company, were sent to the assistance of the *Asche*. It was found by the divers that the hull of the *Asche*, with the exception of the bottom, had remained intact and that the oil carrier was susceptible therefore to being raised by means of compressed air tanks.

After being raised and still kept afloat by the emergency compressed-air tanks, the two wrecking steamers took the *Asche* in tow and brought her safely to New York, where she was docked in the graving dock of the Robins Dry Dock and Repair Company of the Todd Shipyards Corporation. The docking of this vessel with only the information furnished by divers as to where and how high the supporting blocks should be placed was also an engineering feat.

The accompanying photograph was taken after the *Asche* was dry docked. The bottom from the bow to the stern is one continuous wave with an amplitude of four to eight feet. Undoubtedly the Isherwood system of longitudinal framing permitted the bottom to take a wave formation without breaking, as transverse frames would have presented too many hard spots. At any rate, this system of framing has localized the repairs to the portion damaged. That is, an entire new bottom to a point between eight and ten feet above the keel will have to be fitted, but the sides above this point are in good condition.

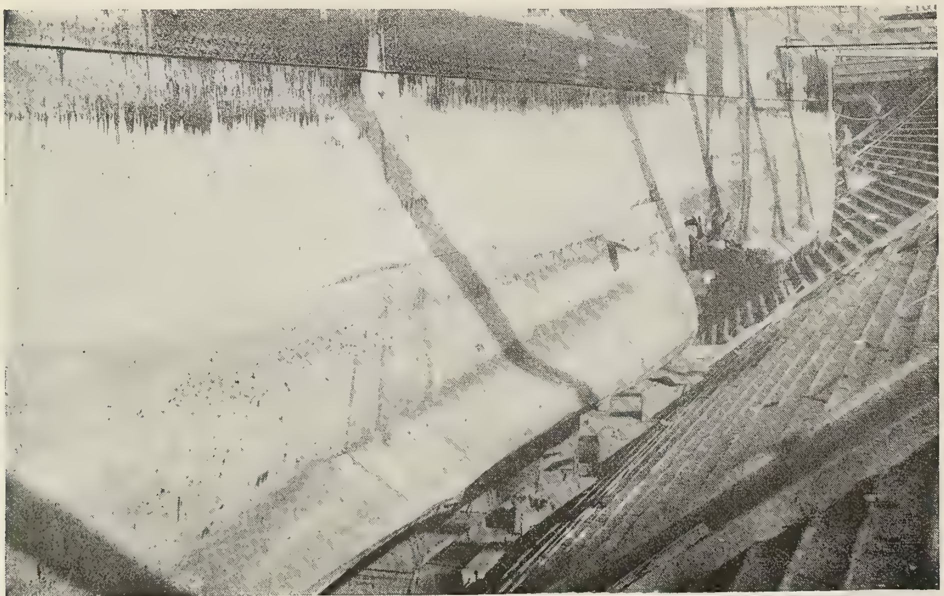


Photo by Todd Shipyards Corporation

The F. D. Asche in Dock, Showing Crumpled and Torn Plates

CONVERSION COMPLETED

Aircraft Carrier Wright Turned Over to Navy Department

The Todd Shipyards Corporation has turned over to the United States Navy the U. S. S. *Wright*, which has been converted into a balloon and seaplane mother ship The vessel is named in memory of Wilbur Wright.

The conversion of this vessel, originally built for the transport service, was carried out at the Tietjen & Lang plant in Hoboken, N. J. It included additions, changes and alterations that would provide for the stowage of six kite balloons for the inflation and housing of kite balloons aft in a balloon well, for the necessary hydrogen generating plant for balloon inflation, for hydrogen stowage and for efficient repair plants for balloons and seaplanes.

The vessel has been arranged for flying operations of kite balloons and as a tender for seaplanes, carrying spare wings and other spare parts. A pigeon coop, aerological laboratory and a complete photographic laboratory have been provided.

A hydrogen generator of large capacity, constructed to use salt water for cooling, a number of hydrogen compressors, a number of hydrogen flasks and an air blower for the kite balloons and two balloon winches will be installed for use in the flying operations and the inflation of balloons.

The repair facilities consist of wire assembly shop, tool issuing room, blacksmith, foundry, sheet metal and coppersmith shop; carpenter and pattern shop, machine shop and motor erecting shop, electrical work shop, fabric and dope shop. Two balloon winches are being fitted for use in flying operations of balloons. A large space forward is provided for wing section stowage, and a large hatch in the weather deck for the purpose of getting the wing sections below. Space will also be available for the stowage of spare parts for kite balloons and seaplanes.

The battery will include four 5-inch 51 caliber guns, two forward and two aft.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Reconditioning Job.—The firm of Theodore Crane & Sons, Brooklyn, N. Y., with a price of $44,875 and twenty-five days, were low bidders for the reconditioning of the United Fruit Company steamship Tanamo, bids for which were opened December 7. The highest bid for the job, submitted by the Atlantic Basin Company, amounted to $83,486 and sixty days.

To Convert Steamer, Hoboken, N. J.—The W. & A. Fletcher Company has been awarded the contract for reconditioning the steamship Lake Fackler, operated by the Clyde Line, bids for which were opened by the Shipping Board on December 5. The vessel is to be converted into a fruit carrier and the specifications called for the providing of eight cargo ports, sheathing of the 'tween decks with planking, the putting up of banana bins, the installation of sixteen ventilators and various other detail work. The Fletcher price was $10,327.

Dredge to Be Overhauled, Shooters Island, N. Y.—The Standard Shipbuilding Corporation, with a bid of $28,000, was awarded the contract for the extensive overhauling of the Municipal dredge Grabit, of the Department of Docks, Pier A, North River, New York.

Large Repair Job, Hoboken, N. J.—The United Fruit Company's steamship Heredia is at the yards of the W. & A. Fletcher Company for extensive repairs, which will probably cost close to $100,000.

Steamer Conversion.—The Bethlehem Shipbuilding Corporation, Ltd., was low bidder for the job of reconditioning the Munson Line steamship Walter D. Munson, bids for which were opened at the Munson Line office in New York on December 6. The Bethlehem Company's bids were (a) $288,500 and 120 days, and (b) $237,680 and 90 days. The ship may be converted into a combination passenger and freighter with accommodations for about 175 passengers. Proposition "A" provided for the building of a shelter deck over the well deck and proposition "B" called for the building up of the superstructure in order to meet the requirements of the specifications.

Reconditioning Contract, New York.—Bids for reconditioning the transport Northern Pacific for passenger service were opened at 3 p. m., on December 15, at the office of the Robert Dollar Steamship Company, 11 Moore street, New York City. It is understood that the award of the contract rests principally between the Sun Shipbuilding Company and the W. & A. Fletcher Company. The prices submitted were as follows: Sun Shipbuilding Co., $335,460, 110 days; Newport News Shipbuilding Co., $401,800, 90 days; Robins Dry Dock & Repair Co., $421,000, 95 days; W. & A. Fletcher Co., $424,710, 85 days; Morse Dry Dock & Repair Co., $550,000, 120 days; Wm. Cramp & Sons Ship and Eng. Bld. Co., $550,000, 240 days; Bethlehem Shipbuilding Corp., $698,000, 140 days.

Steamer Repairs, Brooklyn, N. Y.—The Tebo Yacht Basin, of the Todd Shipyards Corporation, was awarded the contract for repairs to the steamship Bessie Dollar at the opening of bids on Monday, December 12. The price was $1,495.

Barge Wanted, Brooklyn, N. Y.—The United Machine Works, Thomas Jefferson Building, is in the market for the purchase of a barge operated by steam, having a stern paddle wheel, similar to steamers used on the Mississippi river.

Vessel Damaged by Fire, Boston, Mass.—The British steamship Amasis, which arrived at Boston on December 3 from Alexandria with 15,000 bales of cotton, was afire at her pier. Damage sustained is estimated at $45,000.

May Build Schooner, Baltimore, Md.—It is reported that a Cuban representative of business interests in that island was in the city of Baltimore interviewing shipbuilding companies as to the cost of a prospective schooner to be built of steel.

Derrick Boat, Pittsburgh, Pa.—The United States Engineer, Custom House, Nashville, Tenn., has let a contract to the Dravo Contracting Company, Diamond Bank Building, for the construction of a derrick boat at a price of $11,785.

Want Wooden Hulls for Lighters, Portland, Ore.—The Shipping Board is considering the bid of the Port of Portland for four wooden hulls moored in that port. If the bid is accepted, the city proposes to use the hulls for lighters.

To Acquire Steamers, San Pedro, Cal.—It is reported that a statement by Earl M. Leaf, vice-president of the Los Angeles Steamship Company, is to the effect that his company may buy five steamers from the United States Shipping Board which they would have converted into passenger and cargo steamers for the Oriental trade.

Extensive Repairs, Chicago, Ill.—After having been tied up at Philadelphia for about five years, the former Clyde Line steamer George W. Clyde has left for Chicago with a cargo. The vessel will be extensively reconditioned and will be added to the Lake Michigan fleet of the Chicago Steamship Company.

Propeller Contract Award, New York.—The Ferguson-Herbert Corporation, 95 Liberty street, builders of semi-steel, steel and bronze propellers, has been awarded a continuous contract for the supply of propellers for the tugs and Sound steamers of the New England Steamship Company. The Ferguson-Herbert Corporation has similar contracts with a number of railroad, ferry and towing lines in New York harbor.

Boat Contract Awarded, Oakland, Cal.—It is announced from San Francisco that the Pacific Boat Company has been awarded the contract for a new dispatch and towing boat for use about San Francisco Bay, the price being $10,759.

Mechanical Burners, New York.—The Todd Shipyards Corporation has received an order for thirty Todd mechanical burners made by the White Fuel Oil Engineering Company for installation on the Canadian-Pacific Ocean service steamship Montclare, which is now building on the Clyde Bank. This means that the ship will be fully equipped with an American burner system.

To Recondition Steamer, New York.—It is reported that the steamship New York, which was recently sold at a marshal's sale, is to be reconditioned immediately and placed in the Reval-Danzig service as a sister ship to the steamer Gdansk. The vessel will have the same operating and passenger agents as the Gdansk.

Steamship Repairs, Sparrows Point, Md.—The United States Shipping Board has awarded the contract for docking and repairing the steamer Eastern Temple to the Bethlehem Shipbuilding Corporation on a bid of $4,915, and the contract for repairs to the West Lashaway to the H. E. Crook Company at a price of $1,543.

Repair Contract Awards, Hoboken, N. J.—The contracts for repairs to the Tide Water Oil Company steamer Robert H. Hopkins and the Hudson Day Line steamer Hendrick Hudson and the Army transport Wheaton have been awarded to the W. & A. Fletcher Company. The total amount involved will probably be close to $16,500.

Vessel to Be Overhauled, New York.—It is reported that the passenger and freight steamer Argentina, which has just been purchased by the Luckenbach Steamship Company at a price of less than $25 per ton, will be overhauled in New York at a cost of approximately $50,000. She is a vessel of 10,000 tons, and her present passenger accommodations will be taken out in order to fit the ship for the company's intercoastal service.

Service Boat, San Pedro, Cal.—Work is being pushed at the plant of the Los Angeles Shipbuilding & Dry Dock Company on the construction of a combination oil, water, and service boat which, when completed, will be operated by the company to serve shipping in Los Angeles harbor. The boat will be of steel, 88 feet long with 484 tons of oil tank capacity. She is to be equipped also with water tanks and can be used for the transportation of deck loads of lumber or varied cargo.

Reconditioning Contract Award, Seattle, Wash.—The contract for reconditioning the steel steamship Starr, of the San Juan Fishing & Packing Company, has been awarded to the Seattle Shipbuilding & Dry Dock Company, the job to cost about $15,000.

Schooner Repairs, San Francisco, Cal.—The Union plant of the Bethlehem Shipbuilding Corporation was low bidder at a price of $20,996, for repairs to the steam schooner Thomas Crowley, which was recently taken off the rocks near Point Concepcion. Other tenders submitted were Hanlon Dry Dock, $29,160; Moore Shipbuilding, $43,465; Barnes & Tibbitts, $44,098; United Engineering Company, $48,311, and Benjamin Dallerup & Son, $52,800.

To Build Icebreaker, Montreal, Canada.—The contract for the construction of the Canadian Government icebreaker to be used on the St. Lawrence River has been awarded to Canadian Vickers, Ltd., this company being the lowest bidder at a price of $1,580,000. Other bids included the Wallace Shipbuilding Company, Vancouver, $1,872,000; J. Coughlan & Sons, Vancouver, $1,800,000; and the Halifax Shipyards, Halifax, $1,750,000.

May Purchase Freighters, Vancouver, B. C.—It is reported that the Canadian Robert Dollar Company will purchase two large freighters early in 1922, to be added to their present fleet. One of the vessels will be put on the round-the-world service maintained by the Dollar Company, and the other on the Vancouver-Orient Line, thus permitting a thirty-day Oriental schedule.

Lightship Launched, Morris Heights, N. Y.—The steam lightship No. 105 being constructed at the plant of the Consolidated Shipbuilding Corporation for the Baltimore lighthouse district has just been launched, and as soon as ready will be brought to Baltimore to be fitted for service. The new vessel, which is an oil burner, is intended to replace the lightship sunk off Diamond Shoals by a German submarine during the war.

Three New Passenger Liners to Be Built, San Francisco, Cal.—According to latest reports bids have been asked for the construction of three new passenger liners for the coastwise service of the San Francisco & Portland Steamship Company. The company has only one vessel operating between San Francisco and Portland at present and is anxious to put in commission more vessels in order to help out the Rose City, and to replace the steamer Bear, which was lost, and the Beaver, which was taken over by the Government during the war. It is said that the new steamers will be similar to the Bear and Beaver, but will be along more modern lines, to have greater speed and more beam. Passenger accommodations will embody the most modern facilities. The ships will also have a large cargo carrying capacity.

Shipbuilding Activities at Port Arthur, Ont.—It is reported that the plant of the Port Arthur Shipbuilding Company will remain open all winter, giving steady employment to a large number of men. They are doing a great deal of dry docking and extensive repairing on lake steamers and tugs. The steamer Huronton, which is an American boat recently purchased by the Matthews Steamship Company, of Toronto, is to undergo extensive repairs, and will probably remain at the yard all winter. In addition to the general repairs a complete set of new boilers will be installed, the boilers to be de-

signed, built and erected at the Port Arthur Shipbuilding Company's plant. The company has on hand orders for two large boilers for the western market, as well as for low pressure heaters of varying sizes, which will be built during the winter. The company will also build on speculation about twenty low pressure boilers of various sizes, which will be placed on the market. They are also said to be negotiating for the contract to build a big bulk lake freighter in the near future.

Dumper and Scow Repair Bids, Brooklyn, N. Y.—At the opening of bids by the Department of Street Cleaning, Ira Bushey & Son, Brooklyn, N. Y., was low bidder for repairs to dumper No. 8 and the National Dry Dock Company was low bidder for repairs to scow No. 12.

Boat Surveys, New York.—It was learned today that the Department of Plant and Structures is conducting a survey of the nine boats of the Union Ferries, preparatory to taking over these lines, and the Board of Estimate has authorized the institution of condemnation proceedings for the Brooklyn terminals. Plans and specifications for the three electric drive ferries for service to Staten Island are almost completed.

Coastwise Vessel.—Plans and specifications for an 18-knot coastwise, Diesel engined passenger ship have been prepared by Robert W. Bruce, naval architect, Washington, D. C. Mr. Bruce stated that the identity of the owners is confidential at this time. The vessel will carry 150 first class and 50 steerage passengers. The propelling machinery will have 6,000 horsepower.

Alteration Contract Placed, New York.—The New York Harbor Dry Dock Company, with a price of $41,361, was awarded the contract for the installation of a steam heating system in the lower 'tween decks and the putting in of fruit carrying equipment in the Shipping Board steamers, Lake Fillmore, Pulwico, Vinton County and Lake Faristol at the opening of tenders by the Shipping Board at 45 Broadway, on December 12.

Derricks, Nashville, Tenn.—The District Engineer, United States Engineer Office, Post Office Box 900, Nashville, Tenn., will receive bids until 11 a. m., January 16, 1922, for the construction of three steel derricks. The derricks are to be of the stiff leg type and all parts are to be designed to safely withstand the maximum stresses resulting from the following conditions: dredging with an 8,500 pound 1½ cubic yard orange peel bucket with the long boom at 10 degrees with the horizontal or 20-ton live load on short boom at 35 degrees with horizontal and straight-ahead. Engines with a rating of about 12,000 pounds pull are to be used on the boats. The vertical height from deck to the top of A-frame is to be not more than 46 feet, the bull wheel shall be of structural steel or structural steel and steel castings and shall be 16 feet in diameter. All three outfits are to be delivered f. o. b. Fox Bluff, Tenn., a station on the Tennessee Central Railroad about 40 miles from Nashville, Tenn. Both of the 74 by 34 foot derrick boat hulls will be in place to receive the derrick equipment by the time the award is made, but the 76 by 34 foot hull just contracted for will not be delivered until May, 1922.

Boiler Contract Bids, Memphis, Tenn.—Bids for furnishing and delivering two watertube boilers for the United States dredge Beta and three watertube boilers for United States dredge Henry Flad were opened at 3:30 p. m., November 16, at the office of Colonel L. A. Rand, Corps of Engineers, Mississippi River dredging district. The Charles Ward Engineering Works, Charleston, W. Va., with a price of $18,750, was recommended for awarding of the contract for three boilers for the Henry Flad and the Babcock & Wilcox Company, Cincinnati, Ohio, and New York, with a price of $14,353, was recommended for awarding of the contract for two boilers for the Beta.

Packet Boats, New York City.—Plans and specifications for five new packets to ply between New York and Buffalo are under way by R. R. Livingston, Marine Engineer, of 2 Rector street, according to official information obtained by Marine Engineering and Shipping Age. The boats will be equipped with Diesel electric drive and it is believed the total cost will be close to half a million dollars. Preliminary figures place the length of the packets at about 160 feet with a carrying capacity of 500 tons each. There will be two Diesel engines, driving generators, and two motors, driving twin propellers. The power plant of each boat will develop about 260 horsepower. It is understood that the five boats are to be completed by May, 1922.

CONSTRUCTION FOR NAVY

Vessels under construction for United States Navy and their degree of completion as reported November 30, 1921, by the Bureau of Construction and Repair, Washington, D. C., are as follows:

Type Number and Name	Contractor	% of Completion Dec. 1, 1921 Total
BATTLESHIPS (BB)		
45 Colorado	New York S. B. Corpn.	84.9
47 Washington	New York S. B Corpn.	69.8
48 West Virginia	Newport News S. B. & D. D. Co.	65.7
49 South Dakota	New York Navy Yard	36.5
50 Indiana	New York Navy Yard	33.9
51 Montana	Mare Island Navy Yard	27.6
52 North Carolina	Norfolk Navy Yard	36.7
53 Iowa	Newport News S. B. & D. D. Co.	30.7
54 Massachusetts	Beth. S. B. Corpn. (Fore River)	11.0
BATTLE CRUISERS (CC)		
1 Lexington	Beth. S. B. Corpn. (Fore River)	28.8
2 Constellation	Newport News S. B. & D. D. Co.	17.1
3 Saratoga	New York S. B. Corpn.	31.0
4 Ranger	Newport News S. B. & D. D. Co.	3.5
5 Constitution	Philadelphia Navy Yard	12.3
6 United States	Philadelphia Navy Yard	11.5
SCOUT CRUISERS (LIGHT CRUISERS) (CL)		
4 Omaha	Todd D. D. & Const. Corpn.	98.4
5 Milwaukee (a)	Todd D. D. & Const. Corpn.	93.6
6 Cincinnati	Todd D. D. & Const. Corpn.	87.4
7 Raleigh	Beth. S. B. Corpn. (Fore River)	63.7
8 Detroit	Beth. S. B. Corpn. (Fore River)	74.4
9 Richmond	Wm. Cramp & Sons Co.	81.
10 Concord	Wm. Cramp & Sons Co.	74.
11 Trenton	Wm. Cramp & Sons Co.	53.
12 Marblehead	Wm. Cramp & Sons Co.	47.
13 Memphis	Wm. Cramp & Sons Co.	40.

(a) To correct error in October report.

Type Number and Name	Contractor	% of Completion
AUXILIARIES		
Repair Ship No. 1, Medusa (AR1)	Puget Sound Navy Yard	72.5
Dest. Tender No. 3, Dobbin (AD3)	Philadelphia Navy Yard	66.6
Dest. Tender No. 4, Whitney (AD4)	Boston Navy Yard	41.3
Sub. Tender No. 3, Holland (AS3)	Puget Sound Navy Yard	21.5
Aircraft Tender, Wright (AZ1)	Tietjen & Lang	99.3
PATROL VESSELS		
Gunboat No. 22, Tulsa (PG22)	Charleston Navy Yard	71.2

Authorized but not under construction or contract:
(1) Transport No. 2.

Type Number and Name	Contractor	% of Completion
DESTROYERS		
338 Wasmuth (b)	Mare Island Navy Yard	99.9
339 Trever	Mare Island Navy Yard	98.0
340 Perry	Mare Island Navy Yard	82.7
341 Decatur	Mare Island Navy Yard	79.5

Destroyers authorized but not under construction or contract:
(12) Nos. 348 to 359 inclusive.

(b) Ready to be commissioned.

Type Number and Name	Contractor	% of Completion
SUBMARINES		
115 S-10	Portsmouth, N. H., Navy Yard	94.8
116 S-11	Portsmouth, N. H., Navy Yard	92.3
117 S-12	Portsmouth, N. H., Navy Yard	92.1
118 S-13	Portsmouth, N. H., Navy Yard	90.3
123 S-18	Electric Boat Co. (Quincy)	97.0
124 S-19	Electric Boat Co. (Quincy)	96.5
125 S-20	Electric Boat Co. (Quincy)	98.5
126 S-21	Electric Boat Co. (Quincy)	94.9
127 S-22	Electric Boat Co. (Quincy)	95.8
128 S-23	Electric Boat Co. (Quincy)	94.0
129 S-24	Electric Boat Co. (Quincy)	93.0
130 S-25	Electric Boat Co. (Quincy)	93.5
131 S-26	Electric Boat Co. (Quincy)	92.4
132 S-27	Electric Boat Co. (Quincy)	91.0
133 S-28	Electric Boat Co. (Quincy)	91.6
134 S-29	Electric Boat Co. (Quincy)	90.5
136 S-31	Electric Boat Co. (San Fran.)	97.7
137 S-32	Electric Boat Co. (San Fran.)	96.0
138 S-33	Electric Boat Co. (San Fran.)	99.2
139 S-34	Electric Boat Co. (San Fran.)	95.5
140 S-35	Electric Boat Co. (San Fran.)	93.3
141 S-36	Electric Boat Co. (San Fran.)	90.7
142 S-37	Electric Boat Co. (San Fran.)	89.2
143 S-38	Electric Boat Co. (San Fran.)	83.7
144 S-39	Electric Boat Co. (San Fran.)	81.0
145 S-40	Electric Boat Co. (San Fran.)	80.0
146 S-41	Electric Boat Co. (San Fran.)	81.5
153 S-42	Electric Boat Co. (Quincy)	78.1
154 S-43	Electric Boat Co. (Quincy)	78.8
155 S-44	Electric Boat Co. (Quincy)	76.7
156 S-45	Electric Boat Co. (Quincy)	77.3
157 S-46	Electric Boat Co. (Quincy)	75.9
158 S-47	Electric Boat Co. (Quincy)	75.1
159 S-48	Lake T. B. Co. (Bridgeport)	98.3
160 S-49	Lake T. B. Co. (Bridgeport)	97.0
161 S-50	Lake T. B. Co. (Bridgeport)	92.9
162 S-51	Lake T. B. Co. (Bridgeport)	91.0
FLEET SUBMARINES		
60 T-2 (SF 2)	Electric Boat Co. (Quincy)	99.3
163 V-1 (SF 4)	Portsmouth, N. H., Navy Yard	9.7
164 V-2 (SF 5)	Portsmouth, N. H., Navy Yard	8.2
165 V-3 (SF 6)	Portsmouth, N. H., Navy Yard	8.0

Note: Submarines authorized but not under construction or contract:
Fleet Submarines (6) Nos. 166 to 171.
Neff Submarine (1) No. 108.

Returns for Construction Job, Pittsburgh, Pa.—Abstract of proposals for furnishing and delivering six steel dump scows, received in response to advertisement and specifications dated October 24, 1921, and opened at U. S. Engineer Office, Pittsburgh, November 23, 1921:

Nashville Bridge Co., Nashville, Tenn.	$104,340
Charles Ward Engineering Works, Charleston, W. Va.	89,400
Dravo Contracting Co., Pittsburgh, Pa.	70,500
Green Bay Dry Dock Co., Green Bay, Wis.	69,000
John Eichleay, Jr., Co., Pittsburgh, Pa.	100,200
Riter-Conley Co., Pittsburgh, Pa.	83,610
American Bridge Co., Pittsburgh, Pa.	70,200
Midland Barge Co., Midland, Pa.	80,400

SHIPYARDS AND DRYDOCKS

Buys Shipyard, Portland, Ore.—It is reported that the plant of the Peninsula Shipbuilding Company at the foot of McKenna avenue has been purchased by G. F. Matthews, who will operate the yard for the construction of coastwise vessels.

Floating Dry Dock, Green Bay, Wis.—Plans and specifications for the construction of a floating dry dock for the Green Bay Dry Dock Company have been completed by E. J. Morrison, consulting engineer, 53 West Jackson Boulevard, Chicago, Ill. The dock will cost about $300,000.

Plant Addition, Jersey City, N. J.—Plans have been filed by the Vulcan Iron Works, Hudson street, for the construction of a one-story addition to its plant to cost $17,000. Equipment to be installed in this new building is not included in the sum above mentioned.

New Shipbuilding Firm, Quebec, Can.—A new shipbuilding company has recently been organized with a capital of $500,000. The company will establish a yard on the St. Charles River and will employ about 500 men. G. LeClarc, O. Lemay, P. Lepage, A. Milville and F. Choquette, all of Quebec, are interested.

Shipyard Sold, New Orleans, La.—It is announced that the buildings of the Foundation Company's shipyard, which were erected and equipped by the French Government in 1917 at a cost of more than $2,000,000, have been sold at auction for $35,100 to the Oliver H. Van Horn Machinery Company, of New Orleans.

New Company to Operate Yard, Boothbay, Maine.—The Reed-Cook Construction Company was recently organized and has acquired the yard of the East Coast Ship Company for operation. Irving W. Reed, of Boothbay, and Fred M. Cook, naval architect, formerly associated with the Bath Iron Works, are interested in the new company.

May Build Dry Dock, Jacksonville, Fla.—It is reported that the Merrill-Stevens Dry Dock and Repair Company contemplates the construction of a 10,000 ton dry dock, and have had plans under consideration at any time the return of prosperity to shipping lines seems permanent. With the deepening of the channel, larger ships will be coming into Jacksonville and a dock of this size will be necessary.

Shipyard Equipment Sold, Aberdeen, Wash.—The United States Shipping Board has offered for sale all equipment and supplies of the Grant Smith Porter shipyard, comprising supplies having an original value of $300,000 and plant equipment including engines, cables, motors and boiler, as well as miscelleaneous machinery, valued at $200,000. According to Mr. W. F. White, of the Tacoma office of the Shipping Board, the entire holdings will be sold piece by piece, and no sale shall be made for less than $100. Disposal of this yard will mark the closing of one of the wartime yards started by the Board in 1917.

To Build Pontoon for Dry Dock, Seattle, Wash.—It is announced by C. W. Wiley, president of the Todd Dry Docks, Inc., that work would commence at once on the fifth pontoon for the company's large floating dry dock, the construction of which is estimated to cost about $175,000. The fifth unit will also be constructed at Port Blakely as were the other four. This additional pontoon will give the dock a total length of 520 feet, thus insuring the largest ships coming to Seattle, of placement in dry dock without possibility of dangerous overhang.

Proposed Shipbuilding and Repair Plant, Jersey City, N. J.—The Weehawken Dry Dock Company, through Counselor George L. Record, has presented

plans to the city commissioners of Jersey City, N. J., for the construction of a huge shipbuilding and ship repairing plant on a site including part of Jersey City's south cove adjoining the Morris Canal and lying east of Henderson street. The plant would be built immediately provided the city grants the lease asked for, which is for twenty-five years, with an option of renewal for a similar period at the expiration of the first lease. The company proposes to pay a rental to the city of 60 percent of the rate now being paid, and to expend $300,000 for the development of the tract, dredging it, and erecting the shipyard. This project would provide employment for at least 2,000 men.

PORT IMPROVEMENTS

Dock Improvements, Sarnia, Ont.—Extensive improvements to their docks are contemplated by the Port Huron-Sarnia Ferry Company of 304 Quay Street, Port Huron, Mich. Henry M. Morran is president and general manager of the company.

Steamship Terminal Facilities, Charleston, S. C.—The Clyde Steamship Company is reported as contemplating the enlargement of their terminal facilities. Edward A. Kelly is general manager.

Piers, St. Petersburg, Fla.—The city plans to expend at least $200,000 for the restoration of the temporary pier and contemplates building a pier to cost from $500,000 to $1,000,000. Further information may be obtained by addressing the mayor.

To Rebuild Piers, Weehawken, N. J.—Plans are under way for rebuilding the Erie Railroad piers along the Hudson River which were recently destroyed by fire. The work is estimated to cost about $1,500,000. R. C. Falconer, 50 Church Street, New York, is engineer for the company.

Will Replace Dock, New Orleans, La.—The New Orleans Dock Board is completing plans for the construction of a banana loading wharf for the Cuyamel Fruit Company to replace the docks which were recently destroyed by fire. H. M. Gallagher is engineer in charge for the board.

River Terminals, Vicksburg, Miss.—The Federal Barge Line, of which J. T. Atkinson is general agent, Memphis, Tenn., has purchased a site for river terminals. The sum of $400,000 has been appropriated for this project.

Harbor Improvements, San Pedro, Cal.—A comprehensive program for harbor improvements was outlined recently at a meeting of the harbor commission with representatives of the local commercial organization.

Dredging, Lake Worth, Fla.—The Lake Worth Inlet Commissioners have let a contract to the Anderson Dredging Company for the excavation of 20,000 cubic yards of rock and dirt from the Lake Worth Inlet channel, the work to cost about $100,000.

Terminal Facilities, Corpus Christi, Tex.—The city will vote February 23, 1922, on $1,000,000 bonds for the purpose of establishing a navigation district and terminal facilities in connection with a deep water port. T. M. Lawrence is county commissioner.

Pier, Wildwood, N. J.—The Serpentine Railway Company, 2016 West Lippincott Street, Philadelphia, plans the construction of a 200 by 400-foot concrete and timber amusement pier, to cost $250,000. S. G. Matthews, 2016 Lippincott Street, Philadelphia, is engineer.

Wharves, Pensacola, Fla.—The City Commission contemplates the improvement and extension of terminal facilities, involving the expenditure of about $200,000. They propose to acquire the Palafox wharves and adjacent property.

Canal, Georgetown, S. C.—The Rivers and Harbors Committee of the Chamber of Commerce of Georgetown, S. C., W. D. Morgan, chairman, is reported as contemplating the construction of a canal between Georgetown and McClellanville, as part of the inland waterways system extending from Maine to Florida.

Dock Equipment, Tacoma, Wash.—G. W. Osgood, port engineer of the Port of Tacoma, 612 Tacoma Building, will receive bids next February for four 3-5 ton steel cranes of the loft and boom type, one 2-ton electric monorail hoist, 220 v. d. c., about 4,000 feet of monorail trackage, as well as miscellaneous conveying equipment, etc.

Dredging, Wilmington, N. C.—Major Milo P. Fox, District Engineer, has been granted an additional $50,000 allotment for dredging and other harbor improvement work in the Cape Fear River between Wilmington and the sea. The sum of $170,000 is now available for the work. Major General L. H. Beach is chief engineer.

Dock, Tarpon Springs, Fla.—The city is considering the construction of a dock to cost $30,000 for the sponge fleet.

Pier, Gulfport, Fla.—The city will rebuild a 500-foot pier with a "T" head. For further information address the mayor.

Dock and Boathouse, Osceola, Mo.—The Osage Resort Company plans a dock and boathouse on the Osage River, to cost $50,000. G. E. Linn is manager.

Flour Depot, Mobile, Ala.—The Dixie-Portland Flour Company, Memphis, Tenn., contemplates the building of a flour depot on the river front at Mobile.

Concrete Wharf, Houston, Texas.—T. Tellepsen, Prince Building, has been awarded a contract for the construction of a concrete wharf on the Houston ship channel at a price of $189,140.

Municipal Dock, Etc., Bradentown, Fla.—The city Board of Trade contemplates a bond issue and has approved plans for the construction of a municipal dock and waterfront park.

Pier Extension, Bay St. Louis, Miss.—The Hancock County Supervisors have let a contract for building a 150-foot extension to the Bay St. Louis automobile ferry pier.

Docks, Warehouses, Etc., Miami, Fla.—The city has voted $200,000 bonds for two docks, two warehouses and railroad tracks, etc., as well as 100,000 cubic yards of excavation. C. W. Murray is city engineer.

Dredging, St. Petersburg, Fla.—The city plans to dredge Bayboro Basin, involving 100,000 cubic yards of sand and rock excavation, costing $50,000. R. E. Ludwig is engineer.

GOVERNMENT WORK

Dredging, Norfolk, Va.—Specification 4553. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans dredging in Norfolk harbor.

Seawall, Puget Sound, Wash.—Specification 4562. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans the construction of a seawall.

Fire Protection System, Charleston, S. C.—Specification 4558. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans a fire protection system.

Dredging, Newport, R. I.—Specification 4552. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans dredging at Goat Island.

Piping, Charleston, S. C.—Specification 4557. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans the installation of piping for an air compressor.

Quarters, Duluth, Minn.—Specification 4549. The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning quarters at the radio station.

Distilling Plant, Key West, Fla.—Specification 4546. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans a distilling plant.

Wharf Repair, Parry Sound, Ont.—The Dominion Government, Ottawa, Canada, has awarded a contract to Weddell & Saunders, Trenton, for repairing the wharf at a price of $28,866.

Turbo Alternator, Pearl Harbor, T. H.—Specification 4548. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to install a turbo alternator.

Dredging, San Francisco, Cal.—The United States Engineer Office has let the contract for dredging in Richmond Harbor, Cal., to the United Dredging Company of Oakland, Cal., at a price of $143,807.

Substation, Etc., Boston, Mass.—Specification 4550. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans a substation and distributing system at the naval dry dock.

Air Compressor, New York.—Specification 4555. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to install a reciprocating air compressor.

Pier Extension, Puget Sound, Wash.—Specification 4556. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to rebuild and extend Pier 5.

Electric System, Etc., San Diego, Cal.—Specification 4559. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans the installation of gas, water, sewer and underground electric systems, to cost about $100,000.

FOREIGN ACTIVITIES

Motorships, Middlesbrough, Eng.—Two motor cargo vessels will soon be constructed at the yard of the Furness Shipbuilding Company for the account of Furness, Withy & Company. The engines for these vessels are to be of the Tosi type, built by Richardson-Westgarth & Company. The twin screw installations in these ships will develop 2,500 brake horsepower.

Launch First Vessel, Scotstoun, Scotland.—The Blythswood Shipbuilding Company, Ltd., launched its first vessel for Chilean owners on December 15. The vessel is constructed on the Montgomerie-MacMillan system of double bottom construction.

Extensions to Harbor of India.—It is reported that proposals for harbor extensions at Bombay, Calcutta, Kurrachee and Rangoon are under consideration and will soon be taken in hand.

New Steamship Company, Kovno, Russia.—According to a report from Kovno, a new Lithuanian steamship company has been organized, supported by American capital. The company, which will trade mainly in the Baltic, is said to have a capital of $300,000 and to have purchased six steamers in England.

More Motorships, Sweden.—Another Swedish steamship company is reported to have sold four of its steamers, comprising a total of 40,000 tons deadweight, with the intention of using motor vessels in their stead. The company proposes to build sixteen more motor ships.

New Steamship Line, Oscarsham, Sweden.—A new steamship company has been formed to be known as the Rederiaktiebolaget Vallde, with a minimum share capital of 100,000 crowns and a maximum of 300,000 crowns. It is announced that the Rederiaktiebolaget Aeolus has increased its share capital to 750,000 crowns.

Wireless Station, Norway.—According to reports received by the Department of Commerce, Washington, D. C., the sum of 10,000 crowns has been voted for the establishment of a wireless station at Tramso, Northern Norway. The total cost will be 1,250,000 crowns.

New Norway Dock.—Improvements are contemplated in Northern Norway according to reports received by the Department of Commerce, Washington, D. C., the developments in Trondhjem which are already under way being the most important. The new dock for pumping pyrites into ships will cost over 2,000,000 crowns and is planned for an anticipated annual export of 120,000 tons. A new steel bridge will soon be constructed to cost about 3,000,000 crowns. Harbor work is also planned in Finmarken.

Shipbuilding, Lubeck, Germany.—The 5,400 cargo steamer Freifeld has been launched from the yard of the Schiffs & Dockbauwerft Feldner, A.G., Siems, near Lubeck, for the account of the Continentale Reederei A.G., Hamburg, to be placed in their transatlantic services. A sister ship, now under construction for the same company, will be launched in a few weeks, at which time the keel for the first of six vessels of similar tonnage will be laid for the Hamburg American Line.

North German Lloyd Activities, Germany.—It is reported that the North German Lloyd will increase its capital to 600,000,000 marks. The company now has under construction in the Schihau Yard at Danzig a 35,000-ton liner to be placed in the New York-Bremen service when completed, according to latest information. Plans for the company's rehabilitation of its position on the seas have been outlined, and according to Mr. Ehlers, an official of the line, the company now possesses the Vegesack and Bremerhaven, built last year, and both in the Brazilian service; the Westfalen, Holstein, Gotha, York and Gottingen, as well as the Hanover, repurchased from England.

Three Steamers Ordered by Japanese. — The Japanese steamship firm, Tenge & Company, of which Kaiyosha Company, 5 Canton Road, Shanghai, are agents, have placed orders with the Kiangnan and Mitsubishi Docks for the construction of three steamers. The steamers are expected to be launched in March and immediately put into service on the upper Yantze on the Ichang-Chungking run. The vessels will be of uniform size, each 205 feet long, 31 feet beam, and 17 feet deep.

Pier, Hongkong, China.—Bids are being asked for the construction of a reinforced concrete pier, 160 feet 8 inches long by 41 feet 4 inches wide, and approach at Queen's Stature Square.

STEAMSHIP INTERESTS— *(Continued)*

Danzig has been put into effect by steam ship companies at Montreal. Westbound rates from those ports were lowered $1.00 more. The International Mercantile Marine Company recently announced a reduction of 20 per cent in third class passenger rates to European ports. Most of the transatlantic steamship lines operating to continental ports will make a cut in their third class passenger rates, it is reported, the cuts amounting to from $20 to $40. The regular 10 per cent winter reduction in the first and second class passenger rates is now in effect.

BUSINESS NOTES

The firm of Rossell and Thayer has been given exclusive rights for the Philadelphia district by the McNab Company, Bridgeport, Conn., to sell their specialties, with Trenton and Wilmington as the northern and southern limits. In addition to their line of engine direction indicators, logometers and instruments of that character, and their salt detector, boiler circulator, loading draft gauge, the McNab-Vickers lubricated stern tube and the McNab-Kitsell hose couplings, they hold the United States rights for many other marine specialties. Rossell and Thayer have also been given the same territory by the Diamond Power Specialty Company, for the marine field, to sell the Diamond soot blower.

Consolidating the Small Tool and Drill Divisions, the Greenfield Tap & Die Corporation of Greenfield, Mass., has placed P. T. Irvin, formerly manager of their Drill Division, in charge of the consolidation, which will be called the Small Tool Division. Mr. Irvin has for the past three years been sales manager of the Lincoln Twist Drill Company, and prior to that was sales manager of Wells Brothers Company, of Greenfield.

The Atlas Valve Company, manufacturers of reducing valves, pump governors, and regulating devices, are now represented in the cities of Chicago and Detroit, through the offices of the Maher Engineering Company. The Detroit office is located at 744 David Whitney building and the Chicago office at 30 North Michigan Boulevard, in charge of Mr. E. E. Maher.

The Whiting Corporation, Harvey, Ill., has purchased a controlling interest in the Grindle Fuel Equipment Company, manufacturers of complete powdered coal plants for use in connection with malleable furnaces, annealing ovens, steam boilers, billet heating and various other types of furnaces. The Grindle Fuel Equipment Company has moved its offices to Harvey, and will continue its business under the same name. The Whiting Corporation will manufacture all Grindle equipment.

The firm name of Struthers & Barry has replaced the name of Struthers & Dixon, of San Francisco, due to the fact that Fred M. Barry has become a partner in the firm, replacing Captain Andrew Dixon, who retired some months ago.

David G. Reid, Inc., ship brokers, have removed their offices to 12 Broadway, New York.

The Thorndyke-Trenholme Company, a Pacific Coast shipping and chartering firm, has opened a branch office at 17 State street, New York, in charge of Emerson J. Griffith, eastern manager. The company's headquarters are in Seattle. Mr. Griffith was formerly assistant to the vice-president and general manager of the Admiral Line in Seattle.

TRADE PUBLICATIONS

Achievement in Motorships—The McIntosh and Seymour Corporation has issued a catalogue outlining the development of the present Diesel engine designs being produced in the plant at Auburn, N. Y. The American rights for this engine with certain modifications were obtained in 1913 from the Aktiebolaget Diesels Motorer of Stockholm, Sweden. The experience and facilities of this company for engine work are the result of twenty-one years service. Details of the fabricating of the engines in the shops, their installation and operation in motorships are described and illustrated, comparative diagrams and charts are also shown giving the economies possible with motor driven vessels.

Valves—Types of valves and asbestos packed cocks for every manner of marine and stationary service are illustrated and the specifications and uses outlined in a book issued by the Pratt & Cady Company, Inc., Hartford, Conn. This catalogue supersedes all previous issues and the terms, discounts, prices, guarantees and the shipment allowances mentioned are correct to date.

Normand Diesel Motors—A unique method of presenting information on Diesel motor products by a foreign firm is embodied in a catalogue which has been received from the Chantiers et Ateliers Augustin Normand, Le Havre, France, in which transparent insert pages give the English translation of the original French details of Normand Diesel engines. A history, well illustrated with views of the plant is given of the Normand Works, together with lists of ships fitted with Normand engines. The book also contains a complete treatise of the theory, design and manufacture of the various parts of the engines. Seven plates are bound in the catalogue giving plans and arrangements of engines and ships up to 7,200 tons deadweight capacity. The engines for these ships range from 500 to 1,350 horsepower, the 7,200-ton cargo ship having two of this latter power for her propelling unit.

MARINE SOCIETIES

AMERICA

AMERICAN SOCIETY OF NAVAL ENGINEERS

Navy Department, Washington, D. C.

President—Capt. A. J. Hepburn, U. S. N.

Secretary-Treasurer—Commander J. S. Evans, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Annual meeting and election, first Tuesday in October, other meetings at call of the President.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS

29 West 39th Street, New York.

President—Rear Admiral W. L. Capps, C. C., U. S. N.

Secretary and Treasurer—Daniel H. Cox.

NATIONAL ASSOCIATION OF ENGINE AND BOAT MANUFACTURERS

29 West 39th Street, New York City.

UNITED STATES NAVAL INSTITUTE

Naval Academy, Annapolis, Md.

President—Rear Admiral Bradley A. Fiske, U. S. N.

Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

NATIONAL ASSOCIATION OF MASTERS, MATES AND PILOTS

National President—John H. Pruett, 423 Forty-ninth St., Brooklyn, N. Y.

National Treasurer—A. B. Devlin, 187 Randolph Ave., Jersey City, N. J.

National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

LIST OF OFFICERS, AMERICAN SOCIETY OF MARINE DESIGNERS

President—E. H. Monroe, Washington, D. C.

Vice-President—C. C. Jacobson, New York City.

Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass.

Treasurer—J. B. Sadler, Norfolk, Va.

Executive Committeemen—John Thomson, Bethlehem, Pa.; A. H. Haag, Baltimore, Md.; C. D. Anderson, Washington, D. C.

NATIONAL MARINE ENGINEERS' BENEFICIAL ASSOCIATION

Headquarters 311-315 Machinists Building, Washington, D. C.

President—Wm. S. Brown.

Secretary-Treasurer—George A. Grubb.

ATLANTIC COAST SHIPBUILDERS' ASSOCIATION

1701 Walnut Street, Philadelphia, Pa.

Secretary—C. S. King.

AMERICAN STEAMSHIP OWNERS' ASSOCIATION

11 Broadway, New York

Vice-President and General Manager—Winthrop L. Marvin.

UNITED STATES SHIP OPERATORS' ASSOCIATION

149 Broadway, New York

President—C. H. Potter

CANADA

GRAND COUNCIL, N. A. OF M. E. OF CANADA

Grand President—E. Read, Rooms 10-12, Jones Building, Vancouver, B. C.

Grand Vice-President—Jeffrey Roe, Levis, P. Q.

Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

Grand Conductor—E. A. House, Box 333, Midland, Ont.

Grand Door Keeper—Lemuel Winchester, 306 Fitzroy Street, Charlottetown, P. E. I.

GREAT BRITAIN

INSTITUTION OF NAVAL ARCHITECTS

5 Adelphi Terrace, London, W. C.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND

39 Elmbank Crescent, Glasgow.

NORTHEAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS

Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

INSTITUTE OF MARINE ENGINEERS, INCORPORATED

The Minories, Tower Hill, London.

ITALY

COLLEGIO DEGLI INGEGNERI NAVAL E MECCANICI IN ITALIA.

Via Carlo Alberto 18, Genova.

Marine Engineering
and Shipping Age

Volume XXVII February, 1922 Number 2

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
S. M. PHILLIPS, Associate Editor L. S. BLODGETT, Associate Editor
W. Z. GARDNER, News Editor

Contributing Editors

Rear Admiral C. W. Dyson, U. S. N. William Gatewood
Commander S. M. Robinson, U. S. N. H. McL. Harding
Professor C. H. Peabody William T. Donnelly
Captain C. A. McAllister, U.S.C.G. (Retired) James L. Bates

WE GUARANTEE that of this issue 5,300 copies were printed; that of these 5,300 copies, 4,006 were mailed to regular paid subscribers, 502 were provided for counter and news company sales, 262 were mailed to advertisers, 37 were mailed to employees and correspondents and 493 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 11,050—an average of 5,525 copies a month.

MARINE ENGINEERING is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulations (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

Motorships

THIS issue is devoted largely to motorships and Diesel engines because the developments in this department of marine propulsion are particularly significant at this time. Two large motorship passenger liners have just been completed for the British-African and British-Indian trade, two large motorship cargo vessels, the *Californian* and *Missourian*, are nearing completion in America and plans for several passenger, cargo and Government vessels to be equipped with Diesel engines have been prepared.

With the purpose of giving its readers complete information on these recent developments, MARINE ENGINEERING AND SHIPPING AGE has secured and reproduced in this issue at a large expense the drawings of the *Domala*, which is the first large vessel specially designed as a motor passenger ship; the drawings of the *Californian* and *Missourian*, which are the largest cargo vessels originally designed as motorships that have been constructed in an American yard; the drawings of the *Zoppot*, the largest motorship oil tanker, the drawings of several foreign and domestic motor towboats and an article by Commander S. M. Robinson on the Diesel electric motor drive. Complete information relating to the above mentioned vessels has not, to our knowledge, been published in any other American magazine.

Does New York Really Want an American Merchant Marine?

WHILE the fact that most of the important newspapers of New York city are opposed to a subsidy in any form for our merchant marine does not necessarily mean that they are against American ships, yet the continual indulgence in destructive criticism of Governmental aid to shipping while remaining silent on the protection that is given to manufacturing and agriculture through the protective tariff and the absence of any practical constructive suggestions to take its place would indicate that the sentiment of the largest seaport in the country as far as shipping is concerned is distinctly the preservation of the "status quo."

The newspapers which are horrified at the suggested indirect tax on the American people of say 10 percent of the custom receipts, which would amount to about 30 cents per capita per annum, are not worrying at all about the loss to the country of several hundred million dollars in freight money. In fact they have suggested that the payment of this ship hire would be a possible solution of the settlement of the debts that are due us from foreign countries.

It is quite possible that the shipping nations could settle their obligations to us in a very short time were we to be foolish enough to depend on them for our ocean delivery wagons. Once assured that we are out of the shipping game, they would promptly charge us what they like and they would see to it that our goods were delivered not too soon after merchandise of a similar nature from their own country to in anywise embarrass its sale. In other words, it would become impossible to keep any trade secrets and the foreign merchants could not be blamed if they were to make use of the information gathered from their shipping organizations to anticipate our markets.

Again suppose an English ship were to be in New York harbor when it received simultaneous offers, one to take coal from Newport News to Buenos Aires at $5 a ton and another to take coal from Cardiff to the same port at $4 a ton. What would be the natural and, at the same time, patriotic thing for the owners of the ship to do? Would it not be to try and find a consignment to England, not only for the purpose of taking the coal from Cardiff but also so that more time would be available to secure a return cargo from Buenos Aires?

Then why are the newspapers of New York city against Governmental aid for our shipping on the one hand and jealous of the city's leading position as a shipping port on

the other hand? Is it because the financial interests that dominate the shipping from our leading seaport are afraid that the development of an American merchant marine would create competitors in this and other ports and they are quite satisfied to leave well enough alone, or is it because they cannot see that a tariff on wheat or a manufactured article is the same kind of protection that they are so horrified at seeing extended to shipping?

Thirty-three Knot Passenger Liners

THE proposal to complete certain of our scrapped battle cruisers for the Atlantic passenger service seems to have aroused the British interests, there having appeared in print several statements relative to the projected construction by the British with Governmental aid of a fleet of fast liners, capable of making the transatlantic run from Ambrose Lightship to Lands End in three days. Such vessels are probably practicable from an engineering standpoint. They could accommodate a large number of passengers. They would have a certain advertising value. Nevertheless to put them into service and to maintain anything like the schedule suggested would involve an enormous expenditure, even for a strong Government. The following considerations will, it is thought, lend force to this statement:

Assume a vessel of the following characteristics: Length, 1,000 feet; beam, 105 feet; draft, 38 feet; displacement, 65,000 tons; longitudinal coefficient, 0.58. At 36 knots such a ship would require about 280,000 shaft horsepower and at 33 knots (the speed suggested) about 190,000.

Assume that this ship covers a distance of about 6,300 nautical miles per round trip at a fuel consumption (while at sea only) of 1.1 pounds of oil per shaft horsepower hour. The oil fuel burned per round trip would be nearly 18,000 tons. The cost of oil in such quantities would seem almost prohibitive. It would be hardly possible to carry this amount in the ship's bunkers at one time so the vessel would have to fuel at both ends of her trip.

It is also probable that present day merchant practice with regard to the duty of marine boilers would have to be modified in the case in hand in favor of higher pressures in order to get the steaming capacity required into the ship.

Again it would probably be necessary to resort to 6 screws at a somewhat decreased efficiency compared with the 4 screw installations, with which we are familiar, in order to keep the power per shaft within reasonable limits.

The disposal of the waste gases from a boiler installation of such size is no small problem, particularly when interference with valuable passenger carrying space is considered.

The design of a hull of the size and type suggested which would have the requisite local and girder strength is a serious undertaking.

The foregoing problems, though presenting real difficulty, can doubtless be solved by the designer of today. It may be open to serious question, however, whether it is practicable to drive such a vessel with regularity under ordinary weather conditions in the North Atlantic at speeds approaching 33 knots without excessive damage to upper works and consequent undue expense and possible risk of life.

When it is considered that about 90,000 shaft horsepower for the battle cruisers and about 100,000 shaft horsepower for the vessels having the dimensions noted above would insure a service speed of 25 or 25½ knots and that such a machinery installation would simplify design and construction and greatly reduce the first cost and cost of operation, it appears that the price that would have to be paid for the high speed proposed is prohibitive. But it also shows that the conversion of the battle cruisers into passenger ships, which from an engineering standpoint can be easily accomplished, according to the views of some of our foremost naval architects, is by no means so impracticable from a business standpoint as some people would like to have us believe.

Whether or not the proposal to construct these fast liners is a result of the possibility of the conversion of our own battle cruisers into passenger ships, it shows that the British are well aware of the value of this type of vessel for both war and commercial purposes. No comparison of the naval strength of two countries that does not include the convertible merchant tonnage is correct and, if our statesmen overlook this fact, we may be sure that those of other countries will not.

Shipowners Must Do Their Part

NOW that Congress is to be asked to pass a subsidy bill, it is incumbent on the shipowners themselves to practice the strictest economy in the operation of their vessels. Great strides in this direction have been made by several concerns along the lines of reduced personnel and office expenses, lower manning scales on their ships and the reduction of crews' wages and subsistence allowances.

There remains, however, much that can be accomplished by the economical use of fuel. We assume that very careful consideration will be given to the machinery installations of prospective ships but are there not opportunities to increase the efficiency of a large number of our existing vessels?

In this connection, we note in the annual review number of the Liverpool *Journal of Commerce* that "superheaters for marine boilers are now becoming the rule rather than the exception." If English shipowners reduce their fuel bills by using superheaters and many of our shipowners do not, an opening is furnished for those who oppose subsidies to ask an embarrassing question.

In a like manner, anyone who has witnessed the amount of soot escaping from the stack when soot blowers are in operation cannot fail to be impressed with the possibilities that this equipment offers for saving fuel. There is no material that ranks higher as a non-conductor of heat than soot. Are your boilers fitted with this device?

Space does not permit a discussion of bunkering schedules, care of fires or the economical use of steam after it is generated. It is well known, however, that all these departments offer excellent opportunities to make a real saving in the cost of operating a ship. Our readers' attention is invited to an address by Mr. R. H. M. Robinson appearing on page 85 and an article by Mr. R. E. Annin published on page 83 of this issue. We shall not deserve a subsidy unless every effort is made to reduce operating costs to a minimum.

Governmental Aid

CALL it by whatever name you please, a subsidy of some form or another must be granted to American ships or our merchant marine will disappear from the seas. On this question practically all marine authorities agree, qualified, of course, by the reservation that the amount of the subsidy should not be in excess of that which is necessary to maintain in successful operation only those vessels that are of desirable design and efficiently managed.

A good and sufficient argument for the prompt passage of the Governmental aid that the President will shortly ask Congress to give our merchant marine, and which did not exist at the time the Gallinger subsidy bill was defeated by three votes in the House, is the fact that the Government will be able to save many millions of dollars by granting a subsidy that will make it possible to dispose of the Shipping Board vessels to private owners.

Not only is there no chance to interest private capital in the Government-owned vessels, 1,000 of which are now tied up, without some assurance that shipping as well as other industries will receive some form of protection, but there is also no other method by which the enormous drain on the public treasury which is caused by the care and upkeep of these tied-up vessels can be so efficiently stopped.

Having Chairman Lasker's figures, which were recently given to the Committee on Appropriations, to the effect that only one of the four millions that at present constitute the monthly loss of the Shipping Board is going for actual operations, the so-called "Watch Dogs of the Treasury" will think twice before they vote against a bill that is the only hope of getting the Government out of the shipping business.

The Next Marine Exposition

THE American Marine Association, formerly the Marine Equipment Association of America, has secured the Grand Central Palace for the next annual marine exposition, which will be held during the week of November 6. Although the first exposition was held at a time of severe business depression, it was an unqualified success, which was due in a large measure to the splendid cooperation given by the practical and technical marine associations and societies.

The Society of Naval Architects and Marine Engineers has decided to again cooperate in the coming exposition by changing the date of its annual convention from the week of November 13 to the week of November 6, thus securing the opportunity for its members to inspect the new developments in the marine field relating to their profession.

Influential members of other marine associations are known to favor holding their conventions during the week of the exposition.

The American Marine Association, in addition to sponsoring the annual marine show in New York, will function during the year as a Chamber of Commerce in the marine field, thus enlarging its scope to include any legitimate opportunity to aid in the development of an adequate American merchant marine.

The President's Shipping Plan Will Succeed

Watchdogs of the Treasury Know That the Nation Will Save Millions of Dollars by Protecting Our Merchant Marine

By "Old Scotch"

AT this writing plans for a comprehensive system of aiding the American merchant marine are rapidly taking form. Lines are already becoming drawn as to the attitude individuals, associations and the public press will take in the approaching contest before Congress. As the action of that body is largely guided by public opinion, especially on the eve of an approaching election, it is well for those of us vitally interested in the subject, and that includes everyone directly or indirectly connected with the shipping industry, to look about and see what the future portends.

Already the writer has heard quite a number of men prominent in the industry express grave apprehension of the outcome, their fears being based on the failure of past attempts and what they consider the widespread disapprobation of the public concerning the aiding of any one industry at the expense of the general Government.

Attitude of the General Public Favorable

The writer has as wide an acquaintance among people generally as the average man, and perhaps more. Thus far he is happy to state that this feeling of apprehension seems to be confined to those in the industry. It has been most pleasing to him to note the almost general approval of the scheme among the laymen with whom he has discussed the general subject. Such expressions as, "Why, of course, we must subsidize our merchant marine: we cannot expect Americans to go to sea for the same rate of wages paid to foreigners." "What is the use of temporizing with the subject: we must have a merchant marine and we are willing to pay for it," are quite frequent among people who have no direct connection with shipping whatsoever.

The writer talks merchant marine and subsidy on every occasion which presents itself, and to all classes with whom he comes in contact. Having a very good recollection of the two previous attempts to enact legislation for direct aid to our shipping, he has reached the conclusion at this stage of the present agitation that a marked change has come over the public generally in its attitude towards and its knowledge of shipping. He therefore wants to go on record in predicting that whatever relief President Harding may see fit to recommend for our shipping in the foreign trade, the measure will be enacted by Congress without any great opposition. In support of this prediction the following reasons are submitted.

Why Congress Will Aid Shipping

At the time the last subsidy measure was before Congress, it is estimated that there was not more than two hundred millions of dollars invested in ships capable of engaging in overseas trade. The people of the South and Middle West were not in the least interested in shipping, and were almost unanimously arrayed against the principle of what they

termed special privilege to any industry. English and German steamship interests, fearing the loss of trade on the ocean, waged a vicious propaganda against the proposed legislation, which was very easily swallowed by people in the Middle West, who then had not become educated to the national value of shipping and who, in common with the rest of us gullible Americans at that time, had not learned to discern foreign propaganda in our daily press, thinly guised as it was then put up to us. Our export trade in manufactured goods was very small in volume, the products of the soil and mines sent abroad then predominated to a marked degree.

Despite this comparative lack of interest and of powerful backing in any particular line, the so-called Gallinger-Frye bill passed the Senate by a very substantial majority and only failed of passage in the House of Representatives by one or two votes. A dissension among the Republican members from Illinois was really the cause of failure. Strange as it may seem some of the strongest and most intelligent backing for this bill came from the states of Ohio, Indiana and Illinois. No one of these three states could by any manner of means be accused of having direct interest in maintaining American ships in the foreign trade. The underlying motive of the supporters of this measure, who lived in these states, was vision and broad-minded statesmanship. "Uncle Joe" Cannon, still in Congress at eighty-five years of age, was one of the warmest supporters of the measure.

Let us now take stock of the changed conditions which will exert influence on the passage of the next bill.

Our Need for Ships and Shipping Universally Recognized

Basically we have changed our economic conditions so that now our manufacturing interests exceed our agricultural and mining efforts. We have not less than 15 percent of surplus products which must be sold abroad, in competition with other producers which have their own ships to deliver their goods in these competitive markets. It needs no complex argument to convince even a schoolboy that no concern can sell its goods in competition without having its own delivery system. That fact is pretty thoroughly grounded in the minds of all American citizens.

Before we entered the great war there was an insistent demand for the products of the American farms and factories throughout all Europe. We had the orders and the goods to fill them but, along in 1914 and 1915, it suddenly dawned on our exporters that we did not have the ships in which to deliver them. Germany's entire merchant marine had disappeared from the seas. England's cargo ships, as well as those of many of the neutrals, were being ruthlessly "strafed" by the relentless German U-boats. Our wharves and freight yards at the leading American seaports were rapidly congested and all of us along the seaboard became familiar with stacks of machinery and manufactured goods dumped along the railroads, sometimes three or four miles away from the wharves, because there were not sufficient ships to carry the goods to suffering Europe. The farmer and manufacturer in the interior were acutely aware of the lack of shipping facilities, when their bankers could not advance them money on undelivered goods. All of this has sunk deeply in the minds of the people, and shipping is now throughout the length and breadth of our land viewed much more intelligently than ever before.

Another factor, also a heritage of the war, must be taken into account and that is that the three million and over of the picked young men of America, the very flower of our country, have made at least two ocean voyages on their way to and from the battlefields of France. The majority of these had to travel under foreign flags, owing to an insufficient number of American ships. However, the main point to them and to the country is that they now have an intelligent idea of ships and the ocean. Every city, town and hamlet throughout the land now contains among the population at least one or more intelligent young men who can speak knowingly of the value of ships and discourse to their associates on their experiences at sea. Ships and shipping are no longer enigmas to the ranchmen of Wyoming, the cotton planter of Texas or the farmers of Kansas and Nebraska.

Shall We Scrap the Billions of Dollars We Have Invested in Ships?

Viewed from an investment standpoint how vastly different are the conditions now? Within the past five years it is conservatively estimated that not less than five billions of dollars of our national wealth has been invested from public and private funds in ships and shipbuilding facilities. They are not worth that much today and, if legislation is not enacted to make their operation profitable, this vast sum may as well be wiped off our ledgers. But "money talks" because of the thousands of men to whom capital gives employment to make it talkative, and it is not conceivable that people who are as shrewd in money matters as we are reputed to be will supinely lie down and see this tremendous amount of our savings entirely dissipated for the lack of a little intelligent legislation to rescue it from the scrap heap.

Viewed from a political standpoint, and everything we do as a nation has more or less politics in it, the outlook is very encouraging. Previous attempts at subsidy legislation were fought out along party lines, the Republicans favoring it and the Democrats opposed. Now it is entirely different, as party lines have disappeared. Some of the ablest proponents of all beneficial legislation are Democrats. The South is as deeply interested in shipping as are the East and West. The great Mississippi Valley, the very heart of the country, now realizes that we must have our own ships to market their products, as never before. President Harding, always a staunch believer in and a supporter of our merchant marine, deems the matter of such transcendent importance that he will appear personally before Congress and urge the passage of the legislation he deems necessary. He will not do this for party politics, but in the best interests of the nation.

Both Political Parties Pledged to Support the Merchant Marine

It must be remembered that the platforms of both the great political parties contain planks pledging each to the support and building up of our merchant marine. That is one subject upon which we, as a nation, have had but very few differences of opinion. The doctrine was first strongly enunciated by Thomas Jefferson and throughout our national history has been endorsed by the great men of both parties. What other one national policy could enlist the modern day support of such leaders as Wilson, McAdoo, Underwood, Harding, McKinley, Cannon and Jones?

They may differ as to the exact means of affording encouragement to our shipping but all recognize that whatever means are necessary must be employed. There now seems but little doubt that President Harding will present a plan for aid which both parties can get behind and push to success.

It must be done, and what *must* be done *will* be done.

This subject is so much the question of the hour for all persons interested in shipbuilding and shipping generally, that all other matters are secondary. We must therefore all of us devote our time and energy to its accomplishment. Never take it for granted that you are going to win, just have faith that you must win, but never relax in your efforts to assure success. Each reader can help the cause in some way. Convince your neighbors that it is the right thing to do, and write to your senators and congressmen that you expect them to vote for it.

Features of the New Shipping Bill

Sale of Government Fleet, Revolving Loan Fund, Income Tax Reductions, Marine Insurance, Immigration, Revision of Navigation Laws, Naval Reserve and Subsidy

By Winthrop L. Marvin*

WHEN President Harding and Chairman Lasker formally launch their shipping bill, they will present a measure of broader scope than has ever been attempted in this country. It will inevitably be known colloquially as the subsidy bill—even Senator Underwood's preferential duty plan of 1913 was so styled while it was under debate in Congress. But the new measure will undoubtedly contain far more than actual subsidy propositions. A long array of important forms of indirect assistance to shipbuilding and navigation has been commended to the Board, of which the first and the most indispensable of all is the sale of the Government-owned fleet "as rapidly as possible, at prices not to exceed the prevailing world market prices for similar tonnage." Already has the Shipping Board begun to function in this direction in the disposal of the *Tuckahoe* and *Absecon*—enabling American shipowners for the first time in a great many years to start with their capital cost on an equality with that of their foreign competitors.

Just how essential this even start is can readily be shown by a comparison based on previous and present figures. The *Tuckahoe* and *Absecon* were of a class once held at about $175 a ton, or a total price of about $900,000. At this staggering figure the annual charges for interest, insurance and depreciation on such steamers would have amounted to $117,000. Assuming that the price at which the ships were lately sold is in the vicinity of $35 a ton, these fixed charges, based on a total cost of $178,500, would be $23,205 a year.

Fixed Charges

The former capital cost would have made competition and success absolutely impossible. The present price makes success a probability. With equality in capital costs between American and foreign ships, all that remains to be covered is the higher wage and subsistence cost of American vessels, amounting in the case of such ships as the two under consideration to less than a thousand dollars a month, or $12,000 a year. This is a subsidy which seems easy and practicable. It is a small price for the American nation to pay for the service of an efficient unit of a great merchant marine.

Revolving Loan Fund

Another recommendation which the Administration, the Shipping Board and the leaders of Congress will consider in the making up of an adequate bill is a proposal for a revolving merchant marine loan fund of $100,000,000, to be applied especially to encourage the construction of liners and other special types of ships in which the American merchant service is today deficient. It is assumed, and it ought to be possible, when this fund is once secured, out of proceeds of the sale of Government-owned ships or if necessary by a bond issue, that the fund, properly handled at a fair rate of interest, would reproduce itself year after year so that no further additions to it would be necessary. Many nations have tried this plan of loans on sound business principles to encourage shipping. There is no reason why it should not succeed in our case as it has in others. For the construction of a new ship the Government loan would be one-third of the capital required, the two-thirds to embody the investment of private capital.

Income Tax Deductions

An entirely new feature in American maritime policy would be a deduction from net Federal income tax, payable by shippers or travelers, of a certain percentage of the freight moneys on either exports or imports and on passenger fares in American ships. This is an expedient of unexplored possibilities. It will certainly create a strong, constant preference for the American flag on the part of exporters, importers and travelers. It is a substitute for Section 34, subject to none of the objections of the other plan and not forbidden in any way by treaty stipulations. It is an indirect aid, but one likely to prove exceedingly potent—something which observers will watch with steadily increasing interest.

Our principal maritime competitors have dealt liberally with their shipping in the matter of depreciation since the great war. These nations have recognized the fact that actual depreciation has been abnormal and they have allowed their shipowners to work down their valuations to a point conformable to the depreciation that has actually occurred, thus placing their shipping on a conservative basis and relieving it of inordinate taxation. This is a problem of the Treasury Department, but it can be greatly facilitated by constructive legislation.

Marine Insurance

Powerful marine insurance facilities are an essential part of the development of an American merchant marine. The Shipping Board tonnage has been grievously discriminated against by underwriters, sometimes in this country and more insistently abroad. The temper of the Shipping Board is to meet this issue boldly so far as Government-owned tonnage is concerned. But it is important to remember in whatever is done in this direction that the Government must avoid any actual competition with established marine insurance facilities of the United States. The popular demand to take the Government out of business and keep it out is strong not only in the operation of the ships but in their insurance.

Immigration for American Ships

One-half of our immigration for American ships is an expedient which should appeal as just to the country, which realizes that the immigrant business is the most profitable of all. Particularly, at existing immigrant passenger rates, control of 50 percent of our immigration in American ships will do even more than direct subsidy to strengthen transatlantic liner services under the American flag. If our Government has a right to prescribe that immigration shall be limited annually to 3 percent of the immigrants of each race already in the United States, it has the right to insist that one-half of the immigrants admitted shall come in American vessels.

It is worth observing that Italy requires that none of her people shall leave Italian ports in any other than National steamers. Once adopted, this reservation of 50 percent of the immigrants to American liners will undeniably become the unchanging policy of our Government. It will help mightily

*Vice-president and general manager, American Steamship Owners' Association.

to create the large, fast steamers of prime value to the National naval reserve. A very important practical advantage is that opportunities for inspection and examination will be possible on these American controlled vessels before they arrive and that generally the immigration laws can be enforced in ways not possible on ships of alien nationality.

Revision of Navigation Laws

No general shipping measure would be adequate which did not involve a careful revision of the navigation laws and rules of the United States. For two years the Shipping Board has had the formal findings of an expert committee on this subject. As a part of a new shipping bill, or simultaneously with it, the La Follette seamen's law and other navigation laws in general should be amended in the light of the needs and principles of today. This need involve no antagonism to labor—for hereafter the labor on American ships is destined to be American and, therefore, not of a kind that instinctively assumes that capital is its deadly enemy

Naval Reserve

A popular feature of any shipping legislation will be the granting of substantial retainers to citizen officers and men of the naval reserve. Nothing will do more to increase the pride of calling of the personnel than a formal recognition of the National need of the officers and crews of the merchant service as especially valuable defenders of the country in a National emergency. Naval reserve ships flying a distinctive flag and officered and manned from the naval reserve enrollment will be a National recognition of the peculiar value of a trained and loyal seagoing personnel. It is true that the old "international" seamen's unions, composed chiefly of aliens, will fight this policy as they have always fought it, but it is full time that these sinister organizations were wholly and forever eliminated from the new merchant marine.

Subsidy for Overseas Shipping

Indirect aids like most or all of the foregoing can be utilized in part to cover whatever higher cost of construction there may be for the new liners and for special types of ships that may have to be added for the purpose of creating a thoroughly symmetrical fleet, in addition to the war-built cargo steamers. But these indirect aids themselves will not suffice. There is undoubted need of direct aid by subsidy also. Those who have given counsel to the Shipping Board on this point have urged that the subsidy to cargo ships and to the faster liners altogether should ultimately be limited to about $30,000,000 a year, or one-tenth of the anticipated revenue from customs. It is an expert estimate that such a subsidy expenditure would cover a very large complete fleet of overseas shipping of about 7,500,000 tons gross register, capable of carrying between 50 and 60 percent of the whole seaborne commerce of America. This subsidy would be paid to privately-owned ships and to Government-owned ships as fast as they are transferred to private capital and enterprise. This would produce a powerful incentive for the purchase of the Government-owned tonnage by equalizing competition with foreign ships and making it possible to operate tonnage under the American flag in world commerce.

An expenditure of $30,000,000 a year is greater than was contemplated in the Frye-Hanna bill of 1901 or the Gallinger bill of 1905, but it must be remembered that it is applicable to a far greater merchant marine, most of which is already in existence.

An Administration Measure

These are all well-considered recommendations. The shipping bill itself will be framed jointly by the Shipping Board and by the leaders of the Senate Committee on Commerce and the House Committee on Merchant Marine and Fisheries. It will not be a mere Shipping Board bill, but a distinctive Administration measure. Unlike any previous efforts this new bill is justifiable on the strong ground that it involves a reduction and not an increase of expenditures. Continued maintenance of the great organization of the Shipping Board and of the Emergency Fleet Corporation, and assumption by the Government of the losses of the operating lines and of the tremendous cost of depreciation of a thousand ships laid up, are heavier drafts upon the National treasury by several times than the entire cost of subsidy disbursements. As Chairman Lasker has again and again declared, Government operation of shipping, even by experienced and able men, is inevitably costlier than private operation, where operators have the incentive of gain and must earn a profit to secure a livelihood.

Proposed Legislation Will Save Millions

It will be demonstrated again and again to Congress in the course of the debate upon the proposed legislation that the Government will save millions of dollars a year for many years by turning the workable Government fleet over to private hands and protecting private owners and operators sufficiently to meet the competition of the lower wages and subsistence, and, in addition, of the State aid of Europe and Japan. There can, therefore, be no pretense on the part of self-appointed watch dogs of the treasury that the interests of economy demand the neglect and destruction of the new merchant marine.

The whole country is weary of Government experimentation in the shipping business. Liquidation of all the vast war-time accumulation of supplies and materials is rapidly going on and will soon be ended. Only the ships remain, and their sale also is imperatively demanded by popular opinion. The issue cannot be dodged; it cannot be ignored. The fact that the Government-built fleet is still on Government hands will keep the question of National policy for the merchant marine constantly before Congress and the country. In the recommendations presented, the President and the Shipping Board have the material for the strongest shipping bill ever written by any men in any nation and they have the spur of economy and retrenchment driving it on.

Urgent Reasons for Subsidy

If the Government is ever going to realize any fraction of the three and one-half billion dollars which the great war forced it to devote to the building of a merchant marine it must be by the sale of the better portion of the war-built fleet to men who best know how to operate these ships under conditions that will afford a living profit. No subsidy proposal has ever come before Congress with any such chance and any such urgency as this. And it is to be remembered that previous shipping bills were beaten only by desperate hyphenate opposition through a nation-wide Teuton propaganda. Moreover, friends of the American ships were then defeated only by a scant majority of from two to eight or ten in the House of Representatives.

Most encouraging is the active, organized movement of American men of business in the Middle West to impress the need of a vigorous American merchant marine upon their public men in Washington. There ought to be a similar movement among the American farmers of the Middle West, who were the heaviest sufferers when in 1914-1915, because of a lack of American shipping, the cost of transporting a bushel of wheat across the Atlantic actually amounted to a greater sum than the farmers themselves received for all the labor and expense of producing that bushel of wheat!

French Tank Steamers.—France has in service an oil carrying fleet of 41,000 tons carrying capacity. Seventeen tankers, aggregating 159,000 tons, are now under construction in France, most of which will be completed by January, 1923.

Shipping Affairs Progressing Rapidly at Capital

Committee Recommends Appropriation for Shipping Board—Chairman Lasker Prophesies This to Be Last Request to Congress

By Harold F. Lane

THE House Committee on Appropriations on January 18 favorably reported the bill providing for the appropriations asked by the Shipping Board and the Emergency Fleet Corporation for the fiscal year 1922-1923. The appropriations requested are $50,000,000 for fleet operations and $50,000,000 for the settlement of claims, of which $30,000,000 is to be immediately available. The bill also provides for continuing the appropriation of March 4, 1921, of $55,000,000 which is to be made available to the Board from the proceeds of the sale of its assets, so that the balance of that amount may be used in its operations during the coming year. For the Shipping Board itself $459,000 was recommended.

In this connection Chairman Lasker of the Shipping Board made a statement, saying that he viewed the action of the committee as a vote of confidence in the Shipping Board. He predicted that if world shipping conditions improve and Congress provides for a ship subsidy which will make it possible to sell the ships now owned this will be the last appropriation of any extent it will be necessary for the Board to ask. He said that he had not wished to make any formal statement of what had been accomplished by the new Shipping Board until it had first formally submitted all the facts to Congress. This opportunity was presented in the hearings before a subcommittee of the appropriations committee just concluded.

Indicates Reestablished Confidence

"When the present board took office," Mr. Lasker said, "the temper of Congress as evidenced in the discussions of the deficiency bill for the Shipping Board was one of lack of confidence in the enterprise and a virtual verdict that the administration of its affairs under me was on trial. In effect Congress said it wanted to be shown. After taking evidence during the past two weeks—over 400 printed pages—in what the subcommittee of the House Committee on Appropriations termed one of the most illuminating and complete hearings ever held before it as to any governmental department, and after investigating in the minutest detail every item of operation, organization and finance, the subcommittee reported favorably to the full committee, and the full committee reported favorably to the House on every request that the Shipping Board made for appropriations for the coming year. This to our mind constitutes more than a mere vote of appropriation. The subcommittee, with a thoroughness that could not be exceeded, explored every bit of work and every important transaction in which the Shipping Board is engaged and its vote to grant the appropriation to our minds constitutes a vote of confidence that inspires us to carry on the important work in which we are engaged.

"We come before Congress showing the Emergency Fleet Corporation for the first time organized as a private corporation, managed by technical men, positioned to compete with private enterprises of a similar nature in so far as that is possible under the handicap of Government ownership. We have erected in the Fleet Corporation an organization that is daily cutting out waste and chicane, and bringing into being orderly processes and improved service that should win back the confidence of the shippers. In this time of depressed world carrying trade practically all steamship companies except those exclusively in the North Atlantic passenger service are losing large sums of money. In proportion to its operations the Fleet Corporation loss is down to a minimum.

Voyage Operating Loss Less Than Million a Month

"With almost 400 ships on the seas the monthly voyage operating loss is less than a million dollars. The balance of the $4,000,000 a month which the Fleet Corporation is requiring at the present time is devoted to repairs and betterments, insurance, cost of lay-ups and administration expense. The slightest upturn in world shipping will immediately result in the voyage operations showing a profit and with an appropriation for the settlement of claims, then, when these are disposed of, a large share of the administrative expense can be done away with. The 400 ships now operating cover practically every port in the world, insuring to the American shipper delivery under the American flag wherever he wills. By proper management in Washington we have improved the service of our operators. We have reduced our payroll from practically $16,000,000 to less than $11,000,000 and at the same time immeasurably improved the character of our executive personnel. We have for the first time in the history of the Board an inventory of its assets and a statement of its assets and liabilities.

Probably Last Request

"With the appropriation asked, by the end of this calendar year the Shipping Board should be free of all debts current and claims and have only outstanding such judgments as may accrue from cases in court. With any upturn in world business the loss should cease, so it is fair to prognosticate that this, the first annual appropriation asked by the present Shipping Board will very likely be the last. If world conditions do not improve and if there is no Government aid to American shipping a slight appropriation may be needed for the maintenance of trade routes in the fiscal years 1923 and 1924 but, by and large, I feel I can verily announce to the country that the end is here of appropriations for the country's great ship enterprise.

"The record made has shown that the Shipping Board has taken the mysteries out of the history of the Shipping Board and in it its readers can find, revealed in every detail, the history of the board from its inception to the present time. We feel pardonable pride in congratulating the country and ourselves that in seven months we can say that, by and large, this is the last loss to any extent, save in the settlement of lawsuits, that the Shipping Board will be to the country. It feels good to make this announcement of an enterprise that has taken $3,300,000,000 of the country's money and to be able to say that after this no more will be needed.

"After the President makes his suggestions to Congress and if Congress should grant Government aid to private shipping we feel that we can liquidate the immense tonnage owned by the Board and that liquidation will bring back to the Treasury much more than the cost of a subsidy. If this happens, within two years I hope and believe that we will be out of Government operation and that the Shipping Board in the liquidation of its assets can be a source of income and not an expense."

Ship Subsidy Plan Soon to Be Announced

The Shipping Board's report containing recommendations on plans for a ship subsidy, the result of its study of various

reports submitted to it by a committee of experts and by the various interests concerned, is about ready to be submitted to the President, who will shortly thereafter go before Congress to urge the enactment of the legislation to carry out the plan finally decided upon. Various predictions are made as to the prospects of getting a bill through Congress and it is certain that a lively fight will ensue before the question is settled. Chairman Lasker of the Shipping Board has been making a number of speeches in various parts of the country in an effort to win public support for the subsidy idea, saying he sees no hope for the future of the American merchant marine unless a subsidy in some form is provided to aid it and that whatever it costs will be more than repaid by making it possible for the board to sell the Government-owned ships to private operators and for the Government to get out of the business of ship operation.

Flexibility Desired

Whatever plan is decided upon, the Shipping Board is anxious to have enough flexibility to the subsidy plan so that it may not be at once made ineffective by the action of some other country in increasing its subsidy to its own ships. For the same reason it is desired that Section 34 of the Jones law be retained upon the statute books where it could be used if necessary.

A draft of a preliminary report of an advisory committee of experts making recommendations to the Board was published in a number of newspapers shortly before the end of the year as representing the administration plan, but Mr. Lasker issued a statement pointing out that this was but one of several reports to be made and that the Board certainly would not approve some of the recommendations there made. The details of the Shipping Bill that the President will ask Congress to enact are outlined as nearly as can be estimated at this time on page 79 of this issue.

Proposed Form of Direct Aid

With regard to the forms of direct aid—a differential payment to American ships based on their higher wage and subsistence cost, and postal subvention to regular services—the funds to be raised by the reserving of one-tenth of the customs receipts and of the increased tonnage taxes—the American Merchant Marine Joint Committee heartily approves the recommendations that have been made to the Board. Of the three proposed plans for granting the differential payment it recommended that "whatever legislation is passed through Congress should be based on the principle of the Gallinger plan of so much per gross ton per year—the faster passenger ships to be encouraged by means of the postal subvention."

The American Merchant Marine Joint Committee believes that the legislation recommended should set forth the general principles upon which the subsidy should be granted as outlined above and that the Shipping Board should be given authority to carry out the details in accordance with those general principles.

In addition to the foregoing it was urged and recommended "that the United States Shipping Board devise some plan of equitable adjustment of the prices for the American shipowners who have purchased vessels from the United States Shipping Board and paid for same either in full or in part."

Concerning Section 34

Homer Ferguson, president of the Council of American Shipbuilders, also submitted a report on the attitude of the council toward maritime legislation, in which the council asserts its continued attachment to the legislation contained in the merchant marine act of 1920. The report said the council is opposed to the repeal of Section 28, Section 34, or of any other section of the merchant marine act which has not hitherto been put into effective operation, on the ground that "the fact that reasons of state may have hitherto prevented the enforcement of these sections, and that such reasons still exist, is no just ground for the repeal of either. They should remain upon the statute books to be instantly available when the state reasons of today give place to the state reasons of tomorrow. It may transpire that other proposed measures in aid of the merchant marine will fail of enactment, or if enacted, may prove ineffective, and if effective, may be of short life. In either of these events the existing sections would prove invaluable."

The report continued in part: "The council believes that the declaration of the merchant marine act, that the purpose of its enactment was to secure to American vessels the carriage of the greater portion of our own commerce, expressed an aspiration so just as to disarm criticism. It believes that the first step towards the accomplishment of this result is to economically exclude from our trade with all nations all ships except our own and those of the other party to the trade. Commerce between nations includes carriage. Nations stranger to the commerce should not be permitted to intrude their ships therein.

"The merchant marine act is a Congressional recognition that the American ship can not take or maintain its place upon the sea, except by effective discriminations in its favor.

Agreement on Form of Subvention Sought

"If reasons exist which at present prevent the discrimination from taking the form of preferential duties, then the less preferable form of discrimination, namely subsidy, must be enacted in the meantime unless Congress is prepared to sacrifice the substance to the form.

"This council does not favor subsidy as an alternative policy to that of the merchant marine act, or as in anywise a substitute therefor, but as a measure of relief until events permit discriminations better suited to the genius of the American people.

"This council recognizes that hitherto measures beneficial to the merchant marine have for many years been defeated by dividing the friends of the merchant marine into hostile camps, each so opposed to the relief proposed by the other, that a cause dear to both has been lost. Those who have favored subsidy have opposed discriminating duties and those who have favored discriminating duties have opposed subsidy, with the natural consequence. Repetition of such a conflict may be expected to produce a repetition of result.

"This council believes that any subsidy measure passed at this time should (a) either avoid appropriation, or if this is necessary, promise continuance; (b) it should be confined to present American vessels of approved class, or to vessels hereafter American built; (c) it should not be of a character to encourage bad ships to remain in the trade; (d) it should provide that vessels hereafter sold by the Shipping Board should carry subsidy or not, as might be provided in the sale.

"In the event that foreign objections are not controlling, it would be desirable that the measure should devote a certain fund to the subsidy, which would not require continual reference in the appropriation bill, thus eliminating the measure from the arena of politics."

Pacific Coast Pool Proposed.—President Harding and the Shipping Board have given their approval of a plan proposed by Pacific Coast interests to form a large company to buy Government vessels in operation from Pacific coast ports, the stock to be distributed as widely as possible among the people of the Pacific coast states. Plans for the creation of a $30,000,000 shipping company on the Pacific Coast will be discussed in Washington early this month, when Chairman Lasker of the Shipping Board will call a conference of the Western interests to consider means of promoting the pool.

Economical Steamship Operation and Management

Bunkers Provide Field Where Most Telling Economies Can Be Practiced—Choice of Ship and Fuel Very Important

By Robert E. Annin

ONE of the most obvious and exacting requirements of successful management is the noting and interpretation of current events and symptoms in all fields, both in relation to present action and to the formulation of the broader and more stable policies which must be framed to meet the probable needs and eventualities of the future. As the present situation clarifies with the passage of time, the market itself is seen to be running very true to form. On the one hand there is an occasional steadying of rates, with slight advance for some trades, which is the natural and predicted result of the voluntary reduction of active tonnage. On the other, it is notable that such demand as exists is almost entirely confined to nearby tonnage, which indicates, on the part of shippers, doubt as to the permanence of the present freight level. This illustrates the continuing threat of the idle tonnage and augurs ill for any immediate relief to owners so far as an increase in gross revenue is concerned.

From the broader point of view, the advance in sterling exchange is an encouraging indication so far as it goes, both as a hopeful sign in the broader fields of commerce and as an element reducing the disadvantage to American owners which was so notable when sterling was at or near bottom.

Normal Trade Awaits European Stabilization

But no real return to normal may be expected in international trade until Europe's industries have gone much further toward revival; until national budgets have been so arranged that taxation will cover expenditure; until the nations realize that the greatest asset of any commercial people is the buying and selling power of its neighbors and customers. The general failure to recognize this last truth is one of the least hopeful signs of the moment. One observer has compared the recent relapse into policies of trade control and trade barriers on the Continent as surpassing any similar situation since the mercantilism of the seventeenth and eighteenth centuries. He adds (referring especially to the new-born nations of Central Europe):

"Each of these states has been trying to render itself economically self-sufficient, through trade embargoes, restrictions and tariffs; each has, however, merely succeeded in rendering itself economically impotent."

Considering the intimate economic relations of European industries and commerce, this is not very optimistic on the general situation. This is (in essence) confirmed by nearly all qualified observers who have had both the opportunity to judge and the training which should entitle their judgment to consideration. As to our own merchant marine, recent utterances seem to indicate that systematic Government aid, such as is generally considered essential, may be on the way. In the meantime, however, owners and operators must do the best they can under the conditions as they exist. Hence the conclusion is reinforced that the only logical course to be pursued for the moment is the rigid practice of all the time-honored economies and a diligent search for new methods of reducing operating costs.

Economies Accomplished

If trade gets no worse, it is probable that the reduction of active tonnage has reached its limit. Economy in subsistence has nearly reached the same point, failing further general decline in food prices, etc. Some operators claim to have reduced this item to 50 cents per diem per capita, as against $1.25 a year ago, and about 35 cents minimum in 1913. Evidently there is not a great deal of room for further saving in this direction.

Further and progressive reductions in the pay roll aboardship are natural developments of the situation and merely confirm the expectations of the trade since the last cut was established and accepted. The Shipping Board is contemplating and private owners have established a further step in this direction—said to reach from 15 to 30 percent—and the end is not yet. No spirit of prophecy was needed to predict that this must come. The mathematics of the situation have made this reduction imperative, failing a radical improvement in business which there was no reason to anticipate last August, and of which there is no real indication now. In truth, this reduction does little than to give official sanction to a pay scale which (in the lower ratings) has been in effect for some time. This is true, at least of many private operators. Sailors, like other people, have lately been wisely applying to their own plight the time-honored proverb concerning the relative value of half a loaf and no bread.

The reduction of construction, scrapping of uncompetitive tonnage and influence of ordinary sea mortality are sure forces working toward a healthier situation in the trade itself but they are slow. The same may be said of international trade, which is, probably (below the surface) tending toward better things. Meantime present conditions must be faced at once by those who purpose to stick in the business.

All this merely clinches the conviction that plans for the future cannot safely be based on any expectation of rates higher than those at present ruling, relatively to operating costs. This can only mean that fresh economies and improved methods must be diligently thought out and put in operation. For the closest figuring in office salaries, sea payroll, subsistence and stores will take but a small bite out of the deficits which now confront the shipowner.

Importance of Efficient Personnel

The broad field in which there is yet much room for saving—direct and indirect—(a saving not easily expressed in figures, but always decisive in the year's balance sheet) is the progressive improvement in personnel, elimination of useless positions and a constant search for men who can fill the necessary jobs ashore and afloat in the most thorough and efficient manner.

This is the essence of time-honored preachments, extending from King Solomon to Elbert Hubbard, and yet it needs to be preached every day. At no time has it been more necessary than in the last seven years. As to the ship and wharf it has been more apparent and flagrant but in many offices, notably those of the newer companies, it has been not less obvious, and in the long run more expensive than inefficiency on the beach, or afloat. Longshoremen and sailors were demoralized by easy money and a surplus of jobs. But clerks, managers, operators and brokers were in many instances "put off their game" equally by the seductive influence of large pay, big profits and enormous commissions. In truth, it is a fair assumption that of the recent past troubles (as related to ship management) at least one-half were due to ignorance, carelessness, slackness and atrocious bad judgment at the shore end. The navigating end was at least protected to some extent by legal requirements as to licensed

officers but in the office manned by greenhorns (or worse) the owner's property was wholly unprotected.

The relaxing effect of the abnormal conditions and the reflex influence of irresponsible competition no doubt affected the whole trade more or less. But by far the greater part of this disturbing factor was due to the new and inexperienced element injected into the trade by the war. The name of the firms of this class was legion; their influence was widespread and most unfortunate; especially accentuating the difficulties of managing or retaining competent help. Being easy marks for the wicked, they were responsible for a very considerable proportion of the extortion and swindling which were so scandalous during and after the war; also for added inflation in every item of cost.

Attention was called in the last article to the remarkable balance sheet of a Scotch company, as showing what might be done in keeping down gross or relative expense by an efficient office force. Such results are only possible with an able and experienced personnel, working at high pressure under proper supervision.

Normal Standards Disregarded

The normal standards in this respect were nowhere maintained during the "boom" freights. Where loss of time was so expensive, it would have been the height of extravagance to sacrifice speed for the sake of economies which (relatively at least) were of minor importance. This, as a moral influence, has not yet been eliminated, although the improvement is already most marked. But in the two years succeeding the armistice it was notable everywhere. Among green operators, laxity, carelessness and even public disregard of the simplest commercial proprieties reached limits which may fairly be described as ludicrous.

The writer vividly recalls happening into one quite pretentious shipping office in mid-afternoon of a business day and finding the president, chartering manager and junior clerk shooting craps in the private office. Yet the concern was handling a very considerable business, because they had in some way secured considerable tonnage for charter and tonnage of *any* kind being then far short of an insistent demand, shippers or charterers were taking anything regardless of the source through which it was offered, and almost regardless of anything except the supreme necessity for room. Probably the crap-shooting president was being paid $20,000 per year and the total office expense was undoubtedly above $50,000.

This is an extreme case; but it illustrates an influence which was much in evidence up to the time when the freight market collapsed. Strong traces of this influence may still be noted in some quarters.

Such matters are elementary. The principles involved became axiomatic to real operators long ago, through the costly teachings of experience. During the period of depression which extended from 1901 to 1910, great progress was made along the line of scientific economy. Except for the demoralization of war markets (foreign, domestic and international), the whole trade would now be much further advanced in this respect. But as conditions now are, and owing to the continuing commercial and moral results of the big war, the shipping world has still some distance to go before it can even regain the average efficiency of 1913. War influences were demoralizing everywhere in the shipping world, but their effect was greatly more injurious here, owing to a greater expansion of activities, based on a relatively smaller nucleus of sound operating firms. The position reached in 1913, therefore, is not good enough today. Owners and operators of American tonnage must now face handicaps which did not then exist.

Foreign Exchange Not Main Cause of Depression

Reverting to the depreciation of foreign exchange, this continues a notable disadvantage to every nation, which, now, like ourselves, pays its obligations in gold or its equivalent. This, of course, includes and affects all costs down to the smallest detail.

It is very commonly stated that the depreciation of foreign exchanges is a main cause in the depression of international trade, on which ocean transportation is so completely dependent. Such statements obviously involve a confusion of cause and effect. The low foreign exchanges are symptomic —not causative. International trade is wholly out of balance owing to conditions only too obvious. Let production and consumption, export and import, resume the normal relations on which the commerce of the last 75 years has been based and the international exchange rates would again become normal. But were it today possible to re-establish by edict the pre-war rates of exchange, the normal commercial relations between nations could not thereby be restored. Disease cannot be eradicated by mere palliatives. So long as the rates of exchange continue to be so distorted, they will, to some extent, react against the interests of American tonnage in varying degrees and (so far as this influence is concerned) in direct proportion to the degree of depreciation. As matters now stand with our maritime competitors, Japanese exchange is nearest to our own and therefore least troublesome to us. Sterling, perhaps next, and German, of course, the most menacing of all.

Selection of the Ship

Assuming the most efficient and economical management as to wages, subsistence, office expense and personnel, the average operator today can at best only reduce operating losses. It is necessary to go further in the line of larger economies and the most important item of operating cost—bunkers—will provide now, and in the future, the field where the most telling economies are bound to be practiced. Leaving out the question of improvements still in the experimental, or semi-experimental, stage, it goes without saying that the first step in this direction lies in the selection of the ship. The next is of course in the choice of fuel—the kind and quality, and the bunkering schedule, which latter may vary according to prices, quality and facilities of ports at either end of the voyage.

A recent writer on this subject asserts that 40 percent of the incompetence of which we hear so much has lain in the choice of ships unsuitable for the completed service; and another 40 percent in the mismanagement of fuel. These are perhaps excessive estimates. No one will be disposed to deny, however, that the suitability of the ship to the intended service is a question with which experience alone is competent to deal, and then only when acting under able technical advice. Allowing for all the confusion and disturbance of trade, it is generally recognized that this matter has been handled, both officially and privately, with an amazing disregard of this main consideration. Sometimes it has been merely misjudgment, sometimes crass ignorance, but sometimes it has seemed to result from nothing less than criminal indifference. In many cases the financial results of such policy—or lack of policy—have been nothing less than appalling.

As to Bunkers

The rise of oil as a power producer has been sensational but, in view of the apparent limits of ultimate supply and the certain increase in demand, it is not clear that oil fuel will show a permanent advantage over coal, so far as steamships are concerned. That will depend on many factors but chiefly upon the price of oil as compared with coal and upon the added gross revenue to be gained by the use of oil.

Ton for ton, oil is of course more expensive. Its advantage lies in its greater heat producing value per ton (a given service therefore requiring a less quantity of fuel) and in the revenue to be gained from the cargo capacity released, by the use of the less bulky and weighty fuel.

Experience shows that the thermal value of good oil is about 50 percent greater than that of good coal, i. e., two tons of oil will produce about as much effective heat as three tons of coal. The waste of lift capacity in using coal is therefore 50 percent more than in the case of oil and such waste will of course appear in reduction of gross revenue paid by cargo.

When war freights were in vogue the results of this difference were amazing. At the peak of the market, and long afterwards, an "alternative burner" could not have afforded to burn coal had it been *free*. The loss in revenue on the sacrificed room would have far exceeded the total cost of fuel oil. Moreover, bunkers being unobtainable in Europe, all transatlantic steamers from this side had to bunker for the round trip, and the normal advantage of oil was thus doubled.

Therefore the advantage of oil for steam making varies with two main factors, which are the relative costs of oil and coal per ton and the level of freights.* Briefly, if oil costs, per ton, twice as much as coal, and the quantity required for a given service be one-third less (or as two to three), the relative first cost will be as twenty to fifteen in favor of coal, or a saving of 25 percent. From this, however, must be deducted the less costly bunkering and stoking of the oil, leaving a margin of first cost in favor of coal. Whenever this margin is wiped out by the increase in gross revenue, made possible by the use of oil, the latter fuel will be cheaper.

The Bunkering Schedule

But when cargo is scarce, and the ship must sail partly empty, there will be no gain in revenue and oil will therefore be less economical. The net result must also be influenced by the level of rates and length of voyage, among other conditions.

*Editor's Note: In the passenger trade, oil fuel has such an advantage in the speed and cost of bunkering, together with the extra space made available for passenger accommodations that the relative cost of coal and oil will probably not be a deciding factor for some years. For example, the *Olympic* is able to make one extra round trip per year since she was converted from a coal to an oil burner. The oil is pumped into her tanks in eight hours as compared with three or four days and over three hundred men for coaling.

With the wide difference in oil prices, here and abroad, the recovery by the English of their bunkering trade and questions as to the relative economy of different qualities to be decided (a most important point in both classes of fuel), it is apparent that there is here a large field for experience, but no place at all for novices. The planning of the long voyage bunkering schedule of the future is likely to be a work of art, requiring a high quality of technique. Certainly the subject is worth all the attention it is likely to receive. Wages and subsistence are constantly discussed and made much of, yet they amount on the average to not over 16⅔ percent of total operating expense. Fuel, on the other hand, may reach 40 percent or more on the ordinary freight carrier. Here is a field in which experience and training are imperatively required.

All these general and specific factors clearly mark the one great economy, without which all attempts at satisfactory results will be futile—a working force constantly increasing in training and efficiency, whose members fit their jobs and whose jobs fit them; extending from high executives to the junior positions; but of course being most essential in the upper grades.

The old established companies, both here and abroad, learned this long ago; and one of their many advantages over comparatively new comers lies in the quality of their selected personnel and in the fact that the best available talent naturally drifts to them. Given this instrument, the specific problems are shorn of half their terrors. Here is where most of the newer companies have been, and still continue, weak.

The greatest operating extravagance is to employ men who are too small for their jobs, because they come cheap. One piece of ignorance, or bad judgment, or bad management is apt to make any difference in salary look negligible.

There is no such major economy as a well selected and cooperating office force, and toward this end every well managed company is straining day by day. This result can only be achieved by a system of consistent and continuous selection, pursued from month to month and from year to year.

Steamship Operation and Its Problems

R. H. M. Robinson, President, American Ship and Commerce Corporation, Addresses the American Society of Civil Engineers

"A DISTINCTIVE characteristic of the shipping industry is the great mobility of its productive factors," declared Mr. R. H. M. Robinson, president of the American Ship and Commerce Corporation and acting president of the United American Lines at the annual meeting of the American Society of Civil Engineers. He referred to ships as productive factors because the services emanating from them are the merchandise of the shipowners.

In calling attention to the 60,000,000 gross tons of shipping in existence today, Mr. Robinson pointed out that "directly or indirectly, actually or potentially, every ton of this 60,000,000 is a competitor of every other ton. A ship built for the New York-South America service does not directly compete with ships operating in the North Atlantic, but it may force another ship out of the South American service and into the North Atlantic. For this reason it is wrong to say that foreign tonnage does not affect conditions in the United States intercoastal trade, for a ship built in Japan for transpacific service may conceivably force an American ship from the transpacific into the intercoastal trade."

Although Mr. Robinson called attention to the limitation of the possible competition of standardized ships with vessels specially constructed to fit the requirements of particular trade routes he claimed that the excess tonnage in the world today was a significant problem to every shipowner. "It means intense competition, scrambling for cargoes, rate cutting and unprofitable business unless the situation is adjusted, either by reduction of tonnage or increase of trade. There has been wide discussion of the advisability of an international agreement for the scrapping of the present surplus of tonnage and the limitation of future building. Most shipowners, however, are holding on as long as they can in the hope that the adjustment will come through an increase of trade rather than a scrapping of tonnage.

Advantage of Long Experience

"It is certainly not out of order to consider where American shipping stands with respect to this general situation and the long competitive struggle which is ahead of us. We suffer handicaps of a very serious nature. Our ships cost more to build, our marine wages are higher and our experience in the business is much more limited than is the case with our principal competitors. I do not intend to go fully into this subject, but there are several points in con-

nection with the last mentioned handicap—our more limited experience—which I should like to discuss briefly.

"Long experience in a business means, among other things, the establishment of helpful connections and the creation of a certain good will in the markets served. In these traffic arrangements the newer American shipping companies lacked sadly during their efforts to get going just after the Armistice. Gradually they are establishing these connections at home and abroad. Too much emphasis cannot be laid on the value of good agents abroad. It is a phase of the problem which is often underestimated. Our ships need good cargoes homeward as well as outward, if they are to yield profits to their owners.

"Long experience also has its benefits in the matter of operating efficiency. Efficiency and economy are problems in every industry and nowhere more than in shipping. It must be evident that in a business which involves such great distances as is the case with a transoceanic shipping company, and in which unexpected conditions are always arising, inefficiency and waste are likely to play a prominent part. While making no claims to exceptional talent in the eradication of these evils, my study of the problem has brought to my attention certain possibilities which may be worth mentioning.

Waste

"Waste may occur with respect to materials and with respect to services. Dealing first with materials, we may look at the question of fuel, which constitutes a very large item in the operating cost of a steamer. It is perfectly patent that a boiler may be fed to a certain point with maximum results and that fuel used beyond that point is sheer waste. Generally, engine room crews are alive to this fact, but very often they carelessly or willfully disregard it.

"Not infrequently we find that ships are driven at an uneconomical speed, thus uselessly increasing the fuel consumption. It is a great temptation to a captain to push his ship to her speed limit in order to make port some hours, or a day, earlier. It takes the closest kind of checking and control by headquarters to eliminate this form of waste; that is to say, to determine what is the economical speed of a given vessel for a given trade under given conditions, and to enforce the proper observance of that speed.

Subsistence

"As regards food, it is recognized that men must be well fed on shipboard, but the wastage that is sometimes encountered is prodigious. Certain of our ships, which have always been run on what was considered an economical basis, are now costing us no more per man per day than they were before the war, although prices are now about 50 percent higher. We have arrived at these results by giving the ships' steward a maximum figure to which to work, and discharging him if he goes above that figure without reasonable excuse. There have been relatively few discharges on this account. The men, however, are entirely satisfied with their food.

"Just as a steward may waste food, so a deck or engine crew may waste paint, lubricants and other supplies. It is a little more difficult to check up on this sort of inefficiency but there is no excuse for allowing it to run wild.

Care of Machinery

"A very common form of waste is that of letting machinery run down for want of proper attention from day to day, so that in the course of time it breaks down entirely and requires extensive overhauling and perhaps replacement of parts.

"It is wasting services to carry a crew larger than is actually required. When business was good we thought we had our crews figured down to the practicable limit, but the pressure of hard times has brought about further reductions, which on some of our cargo vessels have amounted to as many as six, seven and eight men. This has been done, moreover, without handicapping or endangering the ship.

"Services are being wasted when the crew is allowed shore leave to the extent of necessitating that shore labor be brought aboard to do the crew's work. I may say that the American law requiring the payment of half the wages due, on demand of the seamen in port, induces the men to spend more time on shore than is good for themselves or the ship, and not infrequently leads to their being left behind, or to deliberate desertions.

Port Delays

"The most extravagant form of waste is wasting the services of the ship. Several idle days at port, during which time the vessel is earning nothing and is running up expenses at almost the same rate as if at sea, may easily destroy an otherwise fair margin of profit. Every hour counts when it comes to despatching a ship and it takes the concentrated, and one might almost say consecrated, efforts of the operating department, crew, stevedores and all others concerned, to eliminate losses from this cause.

"Recently our operating department worked out a scheme for consolidating at one port fuel delays which formerly had occurred at two ports. We have not figured out exactly what the saving of this arrangement will amount to in the course of the year but it will doubtless run into many thousands of dollars.

"It is self-evident that the elimination of waste in the operation of ships requires a high degree of co-operation as between management and men, and there are many schemes for encouraging this. There is the idea of creating a competitive spirit among the men by comparing the records of different voyages and of the various ships of a fleet. There is the idea of a bonus granted to officers and crew when a ship makes a particularly satisfactory voyage. Sick benefits and superannuation funds also work in this direction. In a large fleet the promotion plan may be effectively used; that is to say, efficiency among the men may be encouraged by holding out to them the possibility of getting higher ratings with the company as a reward for faithful service."

Free Ports and Free Zones

A RECOMMENDATION that there be established in the United States free zones or free ports similar to those with which Europe is familiar was made recently by a committee of the Foreign Commerce Department of the Chamber of Commerce of the United States.

Attention is called by the Chamber's Committee to six arguments in favor of free zones, as follows:

1. Free zones will direct increased transshipment trade to American ports.
2. Free zones will provide facilities for extensive consignment markets for dutiable raw materials.
3. The installation of free zones will provide great improvements in port and terminal facilities.
4. Free zones will make up for the inadequacy of a system of bonded warehouses and drawbacks, in so far as industries manufacturing primarily for export and dependent upon dutiable imported supplies are concerned, and in permitting the rehandling, conditioning and reexportation of imports.
5. Free zones obviate the necessity of advancing large sums for bonds and duty payments, the expenses of customs supervision, etc., and provide an opportunity for earnings for American bankers, insurance companies, forwarders, brokers, and others engaged in handling the port's business.
6. Free zones bring about a simplification and reduction of the work of customs administration.

Shipping Activities of The Department of Commerce

By Waldon Fawcett

From the date of its organization, the Department of Commerce has been, logically, the branch of the United States Government closest in contact with maritime affairs and the best positioned of any of the executive departments to render practical aid to shipping interests. The mere circumstance of the grouping within this Department of the Federal institutions devoted to the science of navigation and the practice of commerce would presuppose such a relationship. For the Department of Commerce has served as a clearing house for the Steamboat Inspection Service, the Bureau of Navigation, the Lighthouse Bureau, the Coast and Geodetic Survey and the Bureau of Fisheries.

RISING above the narrow considerations, the technical considerations, if you please, of the specific maritime activities there has always been manifest in the policy of the Department of Commerce an ambition to offer encouragement to shipping development in its larger or broader aspects. Even in the days when it appeared impossible to arouse widespread public sentiment, the voice of the Department of Commerce was persistently raised in behalf of an American merchant marine just as the Department has habitually collected information with respect to ship subsidies in all lands against the time when Congress will decide to adopt a subsidy system in behalf of the American merchant marine and will have need of models on which to pattern its program. Such has been the versatility of effort that it has several times been suggested that the official title should be "Department of Shipping and Commerce."

Constructive as was the work in behalf of shipping that the Commerce Department performed in the past, a new era was ushered in with the appointment of Mr. Herbert Hoover to the position of Secretary of Commerce. Mr. Hoover's varied business experience, culminating in war-time responsibilities that were conducted on the broadest scale, gave him an acute appreciation of the importance to national development of a progressive policy in the provision of the utmost facilities of water-borne commerce. In an effort to stimulate, by every possible means the shipping and shipbuilding activities of the United States the work of the Commerce Department has been expanded along original lines mapped out by Secretary Hoover. Although the extension has been encompassed within the period of a single year and has not yet had opportunity fully to demonstrate its efficacy, it is apparent that the Hoover administration is to reveal in the commercial annex of the Government at Washington new potentialities of encouragement to shipping.

Bureau of Foreign and Domestic Commerce

One of the most notable efforts in behalf of American shipping interests which has characterized the reorganization conducted by Secretary Hoover has had its outcropping in a quarter where such initiative would be least expected. The Bureau of Foreign and Domestic Commerce has always been one of the most important cogs in the commerce machine but it has been devoted, as its title might imply, almost wholly to the promotion of commerce. Shipping problems have been dealt with only incidentally and to the extent that transportation arrangements affected barter and trade in various markets. Under the new status, the chief function of the Bureau is, as of yore, the discovery and exploitation of "trade opportunities" but shipping interests are to have their distinct share in the "information service."

Prior to a year ago, the organization of the Foreign and Domestic Commerce institution was made up principally of two groups of divisions. There were regional divisions such as the Far Eastern and Latin American and there were technical divisions such as those devoted respectively to foreign tariffs, commercial laws and statistics. With the introduction of the Hoover ideals came the addition of a number of "commodity divisions," so-called. A division, in charge of a specialist, is devoted to each of the basic commodities that form the bulwark of American industry, as, for example, iron and steel, lumber, machinery and electrical equipment. With the advent of these commodity sections there came a Division of Transportation and Communication, in charge of Eugene S. Gregg, and in this new agency American shipping interests may be said to have come into their own in so far as it is beneficial to have the aid of an intensely observant "intelligence service."

General and Confidential Information for Shipping Interests

That is what this new division is, essentially, a bureau of information for shipping interests. By means of the organization of United States consular officers posted throughout the world, by means of special commercial agents and field representatives of the Bureau on roving commission, and by means of intensive, systematic perusal of the press of the entire world, this unique institution undertakes to become apprised promptly of any and every development that might by any possibility affect United States shipping interests. Is Belgium reestablishing its shipping connections? Are port improvements authorized in this corner of the world or is a new coaling station instituted in that corner? The transportation division aims to be the first to get the information for American consumption and to get it in full detail. By means of an internal administrative system the shipping information is segregated from the other data on transportation subjects and is available to shipping men. It might be added, too, that the news of shipping developments to which the Transportation Division gives publicity in Commerce Reports and the other publications of the Bureau of Commerce by no means represents the sum total of the garnered knowledge. The shipping annex is obtaining all the while a wealth of confidential information on shipping subjects which, for one reason or another, it is not enabled to print but which will be communicated in confidence to any authenticated American shipping interest that might be affected by the news.

Specific Services Performed by Department

Coincident with this effort to give American shipping men a bird's-eye-view of the world-wide panorama of maritime development Secretary Hoover has drafted the far-flung field organization of the Bureau of Foreign and Domestic Commerce to facilitate by every possible means the movements of American shipping. Cooperation with the Shipping Board has been particularly close and effective. Illustrative of recent effort in this direction it may be cited that, through the intervention of the London office of the Commerce Bureau, the British Ministry of Transport was induced to instruct the Great Western Railway to give better facilities for American shipments. The London branch was also enabled to

hasten the installation of unloading equipment at Fowey to facilitate the quick "turn around" of Shipping Board vessels at that point. On the other hand, it was due largely to representations made by the Near Eastern and Far Eastern Divisions of the Commerce Bureau that the Shipping Board has been brought to a realization of the importance of maintaining adequate service, via direct lines, to Eastern ports.

During the past year or two the Bureau of Foreign Commerce has revealed one form of useful service to American shipping interests which it is to be hoped will not often be invoked but which is of the highest practical value when needed. Reference is made to the reportorial service covering congestion at foreign ports. At Havana, Cuba; Callao, Peru, and other ports where United States vessels were affected by the unprecedented congestion, the representatives of the Commerce Bureau kept constantly in touch with the situation and were enabled by prompt communication by cable to qualify the Department at Washington to give helpful advice to shippers and ship operators. A special committee from the Bureau visited Cuba at the height of the port congestion at Havana. Not only did this visit bring tangible results in relief of the tie-up but it also established an important precedent in justification of business action rather than diplomatic action in the treatment of shipping problems that may involve two or more nations of the western hemisphere. Notable as has been the work performed by the Foreign Commerce Bureau in the recent past Secretary Hoover is ambitious further to extend the efforts in behalf of shipping. For example, he is to seek from Congress funds that will enable the establishment of technical divisions devoted to "Packing for foreign shipment" and other export responsibilities that are integral with shipping routine.

Improvements in Navigation Laws

The Steamboat-Inspection Service is a branch of the Department of Commerce that bids fair to develop, under the general supervision of Secretary Hoover, more discernedly in line with the needs of the shipping community. For one thing, a renewed effort is to be made to secure the amendment of Sections 4433 and 4418 of the Revised Statutes in regard to the working and hydrostatic pressure of boilers. This is an issue which has been raised repeatedly by the manufacturers of boilers and the service has been criticized because of its rules and regulations but the modernizing of these rules has waited upon authority from Congress.

A drive will also be made to bring about the amendment of Section 4472 of the Revised Statutes which governs the transportation of dangerous articles. As now enforced this law is worse than obsolete. It was originally enacted solely to meet conditions induced by the operation of a certain class of vessels on the western rivers of the United States whereas we find it applied today to vessels engaged in offshore trade. If Congress can be induced to take the action that has been recommended, interests engaged in the shipment or transportation of commodities on steamers carrying passengers or on freight vessels would be in a position to know at all times what rules governed the transportation of any dangerous article covered by the code instead of being confronted, as at present, with a formidable amount of red tape. Furthermore, a revision of the law would make it possible to carry on steamers carrying passengers certain commodities that may with safety be carried but which under the present law are entirely prohibited.

Bureau of Navigation Active

The Bureau of Navigation seems to be animated, under the present administration, with something of the same progressive spirit that is manifest in other subsidiaries of the Department of Commerce. Shipping men will rejoice that the new administration is pledged to exert all possible influence to bring about the enactment of the long-awaited and sorely-needed American load line law. It is evident that there cannot be maintained indefinitely the informal arrangement made in 1919 with the authorities of the United Kingdom whereby there is temporary recognition for load lines marked by the American Bureau of Shipping according to the British freeboard tables and rules. The enactment of a load line law would necessitate closer cooperation on the part of the inspection branches of the department with the American Bureau of Shipping and there would, in turn, be a necessity for a small staff of trained ship surveyors in the institution at Washington.

Qualified Experts for Special Services Needed

Eloquent of practical service of the utmost significance to American shipping interests in more ways than one is the aspiration of the Department to create a staff of surveyors similar to that maintained by the British Board of Trade. Such specialists would be available for counsel and decision on questions inseparable from the administration of the navigation laws. And inasmuch as these laws are shortly to be extended and elaborated there will be a proportionately more urgent need for such advisory service. Particularly is there need on Uncle Sam's staff for experts qualified to represent the United States at the important international conferences on safety at sea and kindred subjects which are to be resumed this year.

It will be recalled that the loss of the steamer *Titanic* resulted in an international technical conference that took up such fundamental principles of ship construction as the subdivision of hulls of ocean passenger steamers. The outbreak of the World War postponed the carrying into effect of the international convention that grew out of that conference but the record of the war, particularly in the havoc of submarine destruction, only served to emphasize more strongly the need for the formulation of scientific principles covering this phase of ship construction. To the end of securing an international agreement upon hull construction rules there was an informal meeting last May at which Great Britain, France and the United States were represented. According to the present plan this will shortly be followed by a general conference at which it is hoped that an international agreement will be ratified. To have within the personnel of the Department authorities qualified to represent creditably the United States at this and similar conferences is the immediate ambition of Secretary Hoover and his aids.

Regulation of Radio Communication

Governmental supervision of radio communication is another responsibility integral to shipping with respect to which the present administration at the Department of Commerce has views distinctly at variance with some of the ideals that have prevailed in the past. It is admitted that the regulation of radio communication has become a matter of increasing intricacy and difficulty and that present regulations in the United States do not meet requirements. However, the Department's attitude is that it would be a mistake to press for action by Congress in revision of the regulations applicable to this country alone when there is prospect of revision at an early date of the international regulation of radio communications, in accordance with the project launched in the autumn of 1920 in which there was joint action by representatives of the United States, Great Britain, France, Italy and Japan.

Disintegration of the United States Coast and Geodetic Survey, with attendant loss to the shipping interests of the country, is the most disquieting feature of Secretary Hoover's inventory of the Department of which he has taken charge so energetically. A new building is needed as a home, if this Bureau is to function to the fullest extent, but even more serious than this lack is the low level of salaries obtaining in the Survey which is operating to drive to private fields of employment the experts upon whom the nation has been

(*Continued on page* 90.)

Developments in Marine Insurance

Retrospect of 1921—Ship Lien Issue— Marine Policy Not Valued—Model Bill Passes—Lying-up Returns

By "Bordereaux"

WHEN the final company reports are all in it is not likely that the year 1921 will be found to occupy a particularly impressive place in the history of the business. Enough is in evidence to warrant giving it a very modest ranking indeed. Few marine insurance writers made any money at all last year; and where there was a margin of profit it was narrow to the vanishing line.

One of the reasons is because 1921 was a year of readjustment, the companies groping their way back to normal and familiar conditions; and in such abnormal circumstances it would take a confirmed optimist to anticipate any great degree of money-making. The "war babies" have been shyly withdrawing, and several of the weaker sisters have followed their wise lead. The experienced, old-time offices are still on the job and will doubtless continue to function as actively as ever.

There have been encouraging developments in 1921, and chief of these has been the disposition to get together—something traditionally lacking hitherto among American marine underwriters. This has had its manifestations in the development of the American Marine Insurance Syndicates, the launching of the United States Salvage Association, the merger of the National Board of Marine Underwriters with the Board of Underwriters of New York to the conservation of much expense and effort, and the fine co-operative spirit shown in backing the important marine insurance Federal movements—such as the Load Line Bill, the Model Bill, and the fight to amend the Harter Act. Unquestionably the Syndicates have helped immensely to stabilize the hull insurance market, and their writings have been extensive.

The decline in trade has restricted premium receipts from cargo writings, and this has been still further accentuated by the steady fall in values. Losses in the cargo line have been both numerous and heavy, due to the disposition of foreign consignees to decline deliveries in the face of an adverse market.

So much for 1921. That is past and gone, and insurance men are more interested in what 1922 gives promise of handing them. And, from present indications, the outlook is none too bright, largely because of the intensity of competition and the tendency to cut rates. Americans are charging this condition to British eagerness for business over here. The British insurance market is notoriously top-heavy, as a result of war expansion; and preferential rates have carried to the other side several of our most desirable fleets and numerous cargo lines of exceptional attractiveness. This unsettled condition inclines some of our most sagacious underwriters to anticipate two or three years of hard work to hold business, along with a still more slender margin of profit.

Ship Lien Issue Settled

THE United States Supreme Court recently passed upon a legal point involving between twenty and thirty million dollars, the question being one of liability by privately owned vessels for damages inflicted by them while they were still under Government control. It is a matter that vitally interests the underwriter. It is estimated that there are between three hundred and three hundred and fifty cases of this character pending throughout the country, and practically all for collision damages sustained by privately-owned vessels while the latter were still being operated by the Government. The claimants contend that a lien attached as soon as the collision occurred, and that although these liens were not enforceable because of the fact that the Government had not consented to be sued, nevertheless they became enforceable the moment the vessel passed into other than Government hands. The Supreme Court sustained the contention of the Government that the lien never came into existence because the Government was immune from liability for a tort and that, as this was a tort, no liability was attached to that vessel that could pass when the vessel was restored to its owners from whom it was requisitioned.

Marine Policy Not Valued

ON the issue that a marine contract is not necessarily a valued policy, the United States District Court, S.D., New York, recently found for the libelant in an admiralty suit. In his decision Judge Learned Hand held that in a contract of marine insurance on a particular cargo for a particular voyage, effected by a binder incorporating by reference the New York lighterage form, the insertion of the words "valued at sum insured" does not change the normal character of the policy as a contract of indemnity under which the insured in case of loss is entitled to recover only the actual value of the property lost. The court observed that it is the practice in foreign hull insurance to take out true valued policies, but that no such practice exists in domestic insurance, either hull or cargo. When the parties do not take out such insurance, if the valuation be not fraudulent, both sides are bound. It was objected by the court that the language ought to be clearer when the libelant seeks to change the policy from its express and usual meaning—i. e., as a contract of indemnity—to a contract to pay a fixed sum in the event of loss.

Another important point was that the binder was upon this cargo only for this particular voyage, though its duration was uncertain. It had also to be remembered that the assured drew up the binder. It was held that the phrase "valued at sum insured" referred to the coinsurance clause in the policy and did not change the normal, and expressly agreed, character of the policy as a contract of indemnity.

Barge Canal Writings

WITH the closing of navigation in the New York State Barge Canal, the underwriters viewed their season's accounts with rueful countenances. Briefly, they lost money on their operations. Numerous strandings placed the balance on the wrong side of the ledger. Considerable disappointment was experienced with respect to the unexpectedly small amount of tonnage employed in canal shipments.

Loose Phrases Tabooed

CONSERVATIVE American underwriters have been gratified to learn from a copy of a letter written by the Institute of London Underwriters to similar organizations in other parts of the world that stringent action is being taken by that body to correct the use of loose phrases in insurance policies. The letter lays particular stress on the

term "all risks," and points out that due to interpretation by the courts of this phrase in accordance with its liberal meaning rather than in the light of its insurance significance underwriters are being held for all loss of whatever nature to the goods insured. Conservative underwriters in America have consistently refused to follow Lloyd's lead in the use of this and similarly loose phrased clauses, and it is a satisfaction to them to note that their stand is at last vindicated.

"Model Bill" Passes the Senate

MUCH gratification is felt by insurance men over the ease with which the much-mentioned "Model Bill" passed the United States Senate, and they are convinced that the identical House measure will have no less favorable an experience. Although the bill applies only to the District of Columbia it is designed to constitute a working basis for similar legislation in many if not all of the individual States. It clears the way for American underwriters being placed on a parity with their foreign competitors by the removal of legislative obstacles which now stand in their way and with which the underwriters of other nations are not obliged to contend.

Shipments on Cast-aways Are Total Losses

IT is universally admitted that many vessels are being deliberately sunk, and have been for the past eighteen months, in order that their owners may take advantage of the high valuation under which they were insured. In all of these deplorable instances the "innocent bystander" has been the shipper. His plight is indeed a sorry one, for it has been shown, over and over, that he cannot collect any claim on his insurance policies, nor can he obtain satisfaction from the party to whom he should naturally have recourse—the shipowner. The law is rigid on the point that barratry, in which the shipowner participates, deprives him of the protection of his policy, and the shipper is no less deprived of his right to insurance recovery. He cannot hold the shipowner liable when it is shown that the latter was a party to the fraud. Marine policies cover certain definite perils, but casting-away is not one of them. Nor can underwriters be expected to create the deplorable precedent of paying losses, however arising, which are not caused by perils insured against. The only course for the shipper to take is to pay closer attention to the character of the shipowners with whom he entrusts his property.

Lying-up Returns

MORE or less trouble is reported from England because of the settlement of lying-up returns when the period during which the vessel was laid up is broken by the cancellation of the policy in order that cheaper insurance might be effected. It is contended by many underwriters that under such circumstances the proportion of the return attaching to each policy is not collectible. It is an issue that should not be raised at all. When underwriters permit an owner to cancel his policy and to replace it by a cheaper one they thereby place him in the same position as if the policy had expired in the normal way to be succeeded by another one. It is customary to allow lying-up returns when the period for which they are collected overlaps on succeeding policies, and the fact that a policy has expired through cancellation and not exhaustion does not alter the position in the least. Again, the amount at stake on these overlapping returns must be minute compared with the amount that underwriters have sacrificed by consenting to the cancellation of policies and the substitution of others at cheaper rates. London underwriters are expressing the hope that their confreres as a whole will not countenance the attitude in this matter taken by some of them.

Change in Syndicate Officers

LAWRENCE J. BRENGLE has been appointed active manager of the recently organized United States Salvage Association—which is the operating agent of Syndicate "A" of the American Marine Insurance Syndicates —in succession to Charles R. Page, who recently resigned to engage in marine insurance. John H. Trowbridge, chief clerk of the Syndicates, becomes assistant manager. Gomer H. Rees has resigned as secretary of the Salvage Association, and Mr. Page becomes a manager of Syndicate "A." Mr. Brengle has been the underwriter of Syndicates "B" and "C," and will continue to discharge those duties in connection with his new ones. He brings to his Salvage Association work a wide experience in the handling of wrecked and damaged vessels on both the Atlantic and Pacific coasts. He is a Philadelphian by birth, and has spent ten years in the extensive operations of the large brokerage firm of Johnson & Higgins. Mr. Trowbridge was at one time secretary of the Insurance Advisory Committee of the Food Administration Grain Corporation, and has been with the Syndicates for more than a year.

Losses Caused by Stowaways

ARE marine underwriters liable for damage or loss caused by stowaways? This rather singular question is not without point at this time, in view of a recent heavy claim submitted to New York insurers arising out of a fire in a cotton cargo directly traceable to stowaways lighting a match while lying concealed among the bales in the hold. Despite the fact that a marine insurance policy specifically states that it covers against fire, still there is a question as to the liability of underwriters for such a loss as this. It would seem that, if a loss by fire is caused by stowaways, as fire is one of the insured perils, the underwriters are liable unless their policies contain a clause specifically excluding loss by stowaways, or words to that intent. When a fire is caused by the negligence of the crew the underwriter is liable simply because fire is an insured peril, and the causes responsible for the fire are immaterial, the doctrine of proximate cause not being involved.

Those who maintain that the underwriters are not liable for such a fire as this stowaway one base their contention on the ground that the fundamental principle of marine insurance was created for the purpose of covering fortuitous losses and that a fortuitous loss does not contemplate the careless or intentional act of a party who bears no relationship to the venture. They insist that specific exclusion is not necessary. Under the American law the carrier is doubtless liable for this stowaway loss, but that fact does not of itself excuse the underwriters from their responsibility.

Shipping Activities of the Department of Commerce

(*Continued from page* 88.)

dependent for the fidelity of its nautical charts, tide tables, current, magnetic and triangulation data. Handicapped as it is, the Coast and Geodetic Survey is prosecuting important work; for example, a beginning has been made in securance of observations in New York harbor, the ambition being to provide a systematic tidal and current survey that will aid shipping men by furnishing more accurate current predictions for the docking of large vessels and that will also be of use to the engineers charged with the development at New York of what will be the greatest harbor in the world.

Shipping and Shipbuilding in Great Britain

Vessels Selling at Pre-War Prices — Future of British Shipyards Uncertain—Outlook for Ship Repairing Gloomy

By W. H. Wendon

SIGNS are not wanting that the shipping trade of Great Britain may in the early future take a turn for the better. No surer indication could be found than in the fact that more than one of the country's most astute owners—men who had the good sense to dispose of their fleets at the enormous values current during the late boom—are re-entering the shipowning world and, as compared with the prices at which they sold the boats, are re-acquiring these or purchasing others at something approaching pre-war prices. The course adopted by Sir Walter Runciman, for example, is full of significance. When Sir Walter Runciman sold his well-known "Moor" fleet to the ill-fated Western Counties Company, there were many in the shipping world who were amazed at his action, for at that time—February, 1920—there were hopes that the fabulous values then current would ascend yet higher. But, as is now only too well known, the slump set in with remarkable rapidity, justifying the foresight of Sir Walter Runciman and a few—but very few—others.

But that is a matter of history. What concerns us now is that, as I have hinted, the older shipowners are coming into the tonnage market again, no fewer than six new 9,000- to 11,000-ton deadweight steamers, in addition to older boats, having been acquired by Sir Walter Runciman on behalf of his re-constituted Moor Line. It is particularly noteworthy that these new vessels, which have been constructed by Messrs. William Doxford & Sons, Sunderland, are similar to those which before the war realized sums ranging between £81,000 and £95,000. These figures compare with the £8 per ton deadweight just paid by Sir Walter Runciman, thus exemplifying the tendency to pre-war quotations.

A further recent instance of a shipowner having the courage of his convictions to the extent of purchasing a large fleet is that of Mr. D. R. Llewellyn, of Cardiff, who has become the owner of the Maindy fleet, the method of acquisition being purchase by auction, following seizure by the bank owing to the Maindy Company being unable to meet its obligations.

Fluctuations in Shipping Values

It is not without interest at this juncture to trace the fluctuations in value of, say, a 7,500-ton deadweight cargo carrier. Prior to the Great War the highest price obtained for a vessel of this description was the then huge sum of £60,630, which was obtained towards the end of 1900. With the release of tonnage after the South African war, however, values immediately dropped and by the end of June in 1901 only £49,250 was obtainable.

The fluctuations in the ensuing ten or eleven years are too numerous to describe within the space alloted to this summary. Suffice it, therefore, that by November, 1912, £58,000 was the approximate value placed on this size and type of vessel. From that date until just before the opening of hostilities in 1914 there was a consistent decline in value, the final quotation recorded prior to the war being £45,000. Had the war not intervened, there is excellent ground for believing that values would have dropped still further, and, in the opinion of those competent to judge, the record low figure of 1908, namely, £36,000, would have been attained. But the gods decreed otherwise, the record high figure of £34 10s. per ton deadweight, equivalent to £258,750, being recorded in March, 1920. To-day the best that can be obtained for the type and size of boat under review—and, as already stated, for 9,000- and 11,000-tonners—is £8 per ton on the deadweight, or less than one-fourth of the value current two years ago.

Possibilites of the Future

Now that the new year is fairly launched, it should not be without value to turn for a moment to what our leading shipowners, and those engaged in allied industries, consider to be the possibilities and probabilities of the future. One of the foremost men interested in all branches of the shipping trade—that is to say, ship owning, construction, repairing and chartering—is Mr. J. C. Gould, Member of Parliament, of Cardiff. Mr. Gould, in common with most business men, breathes a sigh of relief at the passing of 1921, which period he rightly describes as one of catastrophe as regards trade and commerce, the slump in its unparalleled suddenness sweeping many firms off their feet and causing widespread unemployment. As Mr. Gould points out it was generally anticipated that the slump would be a gradual one, and would be accompanied by a decline from the abnormal values at which goods and services had soared.

Too Little Business Rather Than Too Many Vessels

But the apparent excess of shipping tonnage, in Mr. Gould's view, is purely artificial. There are, he thinks, not too many vessels on the water—rather, that it might be successfully argued that the depression lies in the fact that there is not enough business to employ the present vessels available. This line of reasoning, as I am sure Mr. Gould would be the first to admit, is open to strong criticism, but at all events it is evidently Mr. Gould's considered opinion, and therefore is entitled to be weighed in the balance, even though it eventually be found wanting. The basis for Mr. Gould's contention is this: By eliminating tankers, passenger liners and intermediate vessels, he arrives at the conclusion that the comparative excess of tonnage is very small. To which, I might add, there is the undoubted presence of large numbers of obsolete and semi-obsolete merchant vessels.

In conclusion, while Mr. Gould does not think things are to be much better for some time to come, he does not despair of the future. He points to the better spirit in trade unionism to-day than there has been in the past and, with the saving of disastrous losses of time consequent on industrial disputes (according to a German statistician, Britain since the Armistice has lost 73½ million out of 90½ million working days lost in the whole world) there is little doubt that brighter days are in front of the British shipping and allied industries.

Prospects of British Shipyards

As to the prospects of British shipyards, none could speak with greater knowledge than Mr. James Lithgow, the president of the Shipbuilding Employers' Federation. Mr. Lithgow traces the present slump to the abnormal prosperity which affected our industrial community in both a material and a moral sense. The material standpoint may be said to be that productive facilities have been improved and extended, and the economics possible to be effected will be discernible when production has a chance to get going. The

moral standpoint may be summed up, that present-day workers, and particularly the younger generation, have the fixed idea that the shortest possible day's work should be given in exchange for the maximum wage obtainable. That, however, is, let us hope, a passing phase.

To return to Mr. Lithgow's analysis, it is of no little interest to note that he views "mass production," either in the shipbuilding industry or any other sphere, as beneficial from the point of view of opening up possibilities for producing goods at a price that a greater number of people can pay. He instances the fact that, if a Ford motor car cost as much as a Rolls Royce, there would be no owners of Fords, but, on the other hand, there would be far fewer owners of motor cars. In the same way, Mr. Lithgow records "payment by results" as being of value to industry in ensuring the largest reward to those who exert extra effort, and in reducing at the same time the total cost of the work performed. Mr. Lithgow is especially serious when touching on the question of foreign competition. Suggestions that this is is of no consequence, and that British shipbuilding can flourish without foreign orders, show, as he points out, ignorance of the facts.

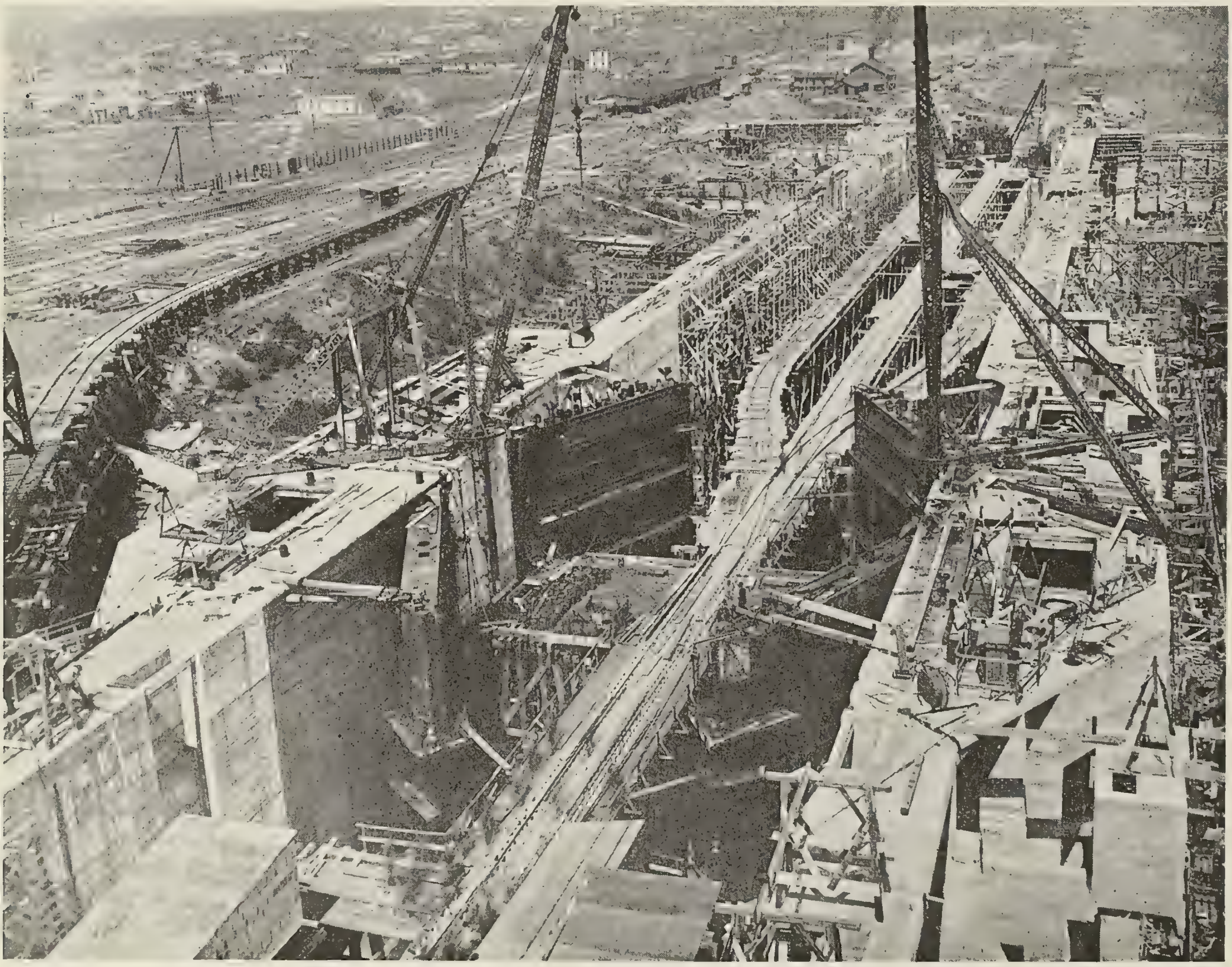
Shipbuilding Depends on Rise in Freight Rates

From a general point of view, the prospects of the British shipbuilding industry are, to say the least, uncertain. The trade, of course, benefits by a rise in rates of freight, for it is then that shipowners consider the advisability of laying down fresh tonnage. But such a fortunate occurrence does not come about until some time after the first signs of a shipowning revival are apparent and, in the meantime, the builder has to bide his time.

But there is another aspect. Throughout the British Isles, in common with other parts of the world, there are large numbers of ships, some nearly completed, others scarcely started. Work on these boats has been under suspension for periods reaching in some cases eighteen months. It is on the cards, therefore, that, with brighter chartering prospects, owners may instruct builders to carry on with construction of their partially finished vessels. Such has, indeed, already been the case in a few notable instances, particularly in regard to liners, where the slump is not so grave.

Ship Repairing

The outlook in the ship repairing industry is as gloomy as, if not gloomier than, that existing on the whole in the "parent" trades—shipbuilding and shipowning. According to one authority, in marked contrast to the comparatively bright outlook at this time last year, the conditions existing in the ship repairing trade at the present time are dismal in the extreme. Indeed, no one engaged in the industry can recall such a hopelessly black prospect. It is generally regarded as being, without doubt, the worst time ever known in the industry.



(Photograph by Kadel & Herbert News Service, N. Y.)

Locks in Industrial Canal at New Orleans, the Second Largest Inland Waterway Scheme in America, Nearing Completion

Motorship Californian Fitting Out at Merchant Shipyard

New American Motorships Californian and Missourian

American-Hawaiian Vessels the First Large Motorships to Be Specially Designed and Built in Their Entirety in the United States

THE *Californian* and *Missourian* mark an era in American shipping and shipbuilding by virtue of the facts that they are the first large motorships specially designed and constructed in the United States and that the machinery is the first of its kind to be constructed exclusively in an American shipyard.

The hulls for the vessels were constructed at the yard of the Merchant Shipbuilding Corporation, Chester, Pa., and the machinery was built and installed by the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., who are licensees for the Burmeister & Wain marine Diesel engines.

Much credit is due the officials of the American-Hawaiian Line for their initiative and judgment in adding these modern vessels to their fleet.

The vessels, which take their names from two former American-Hawaiian steamers sunk by submarines during the war, are of the flush deck type with officers' and crews' accommodations and bridge located together amidship, as is generally characteristic of vessels belonging to this steamship company. This arrangement has much to be commended as it permits the maximum number of cargo hatches and winches to be employed for rapid loading and unloading of cargo and also places the bridge in an advantageous position for the captain in handling the vessel when coming alongside docks.

The main and auxiliary machinery is identical in type to that of the motorship *William Penn,* the machinery for which was installed by the William Cramp & Sons Ship & Engine Building Company in a hull built at the Gloucester Plant of the Pusey & Jones Company and afterwards towed to the Cramp yard for machinery installation. There is a difference, however, in the number of auxiliary engines, the American-Hawaiian vessels having four instead of three, due to the larger number of winches employed.

The motors and generators within the engine room were supplied by the Diehl Electric Manufacturing Company to special requirements. The motors for driving the pumps have ball bearings and are totally enclosed.

The machinery has been built to conform to the requirements of Lloyd's Register of Shipping.

Cargo Handling Machinery

The cargo handling machinery for these ships has been most carefully selected and consists of fourteen double-geared winches and two Shepard Crane & Hoist Company's winches on each ship. The fourteen winches for the *Californian* were manufactured by the American Engineering Company and the winches for the *Missourian* were made by the Maine Electric Company. Each winch is driven by a thirty horsepower electric motor of the "Mill" type. The motors and the controllers for the *Californian* were supplied by the Westinghouse Electric and Manufacturing Company. Those for the *Missourian* were furnished by the General Electric Company.

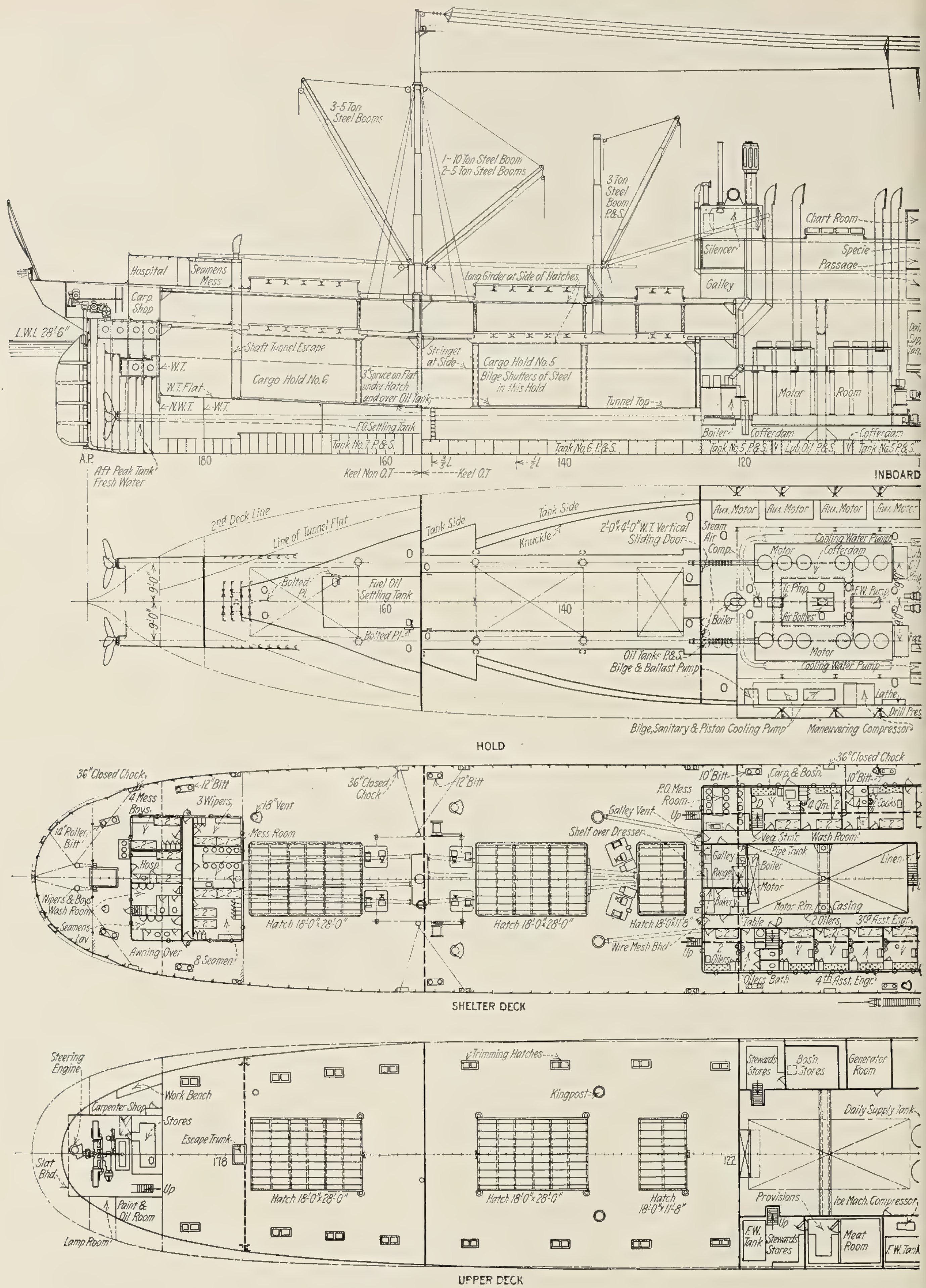
Main Engines

The main engines consist of two Cramp-Burmeister & Wain four cycle marine Diesel engines, of the crosshead type and having six cylinders each with a bore of 29⅛ inches and a stroke of 45¼ inches. Each engine is capable of developing continuously 2,250 indicated horsepower when turning 115 revolutions per minute. They are of the enclosed type and arranged for forced lubrication throughout. To the forward end of each engine is fitted a three-stage compressor for supplying injection air of 850 pounds pressure.

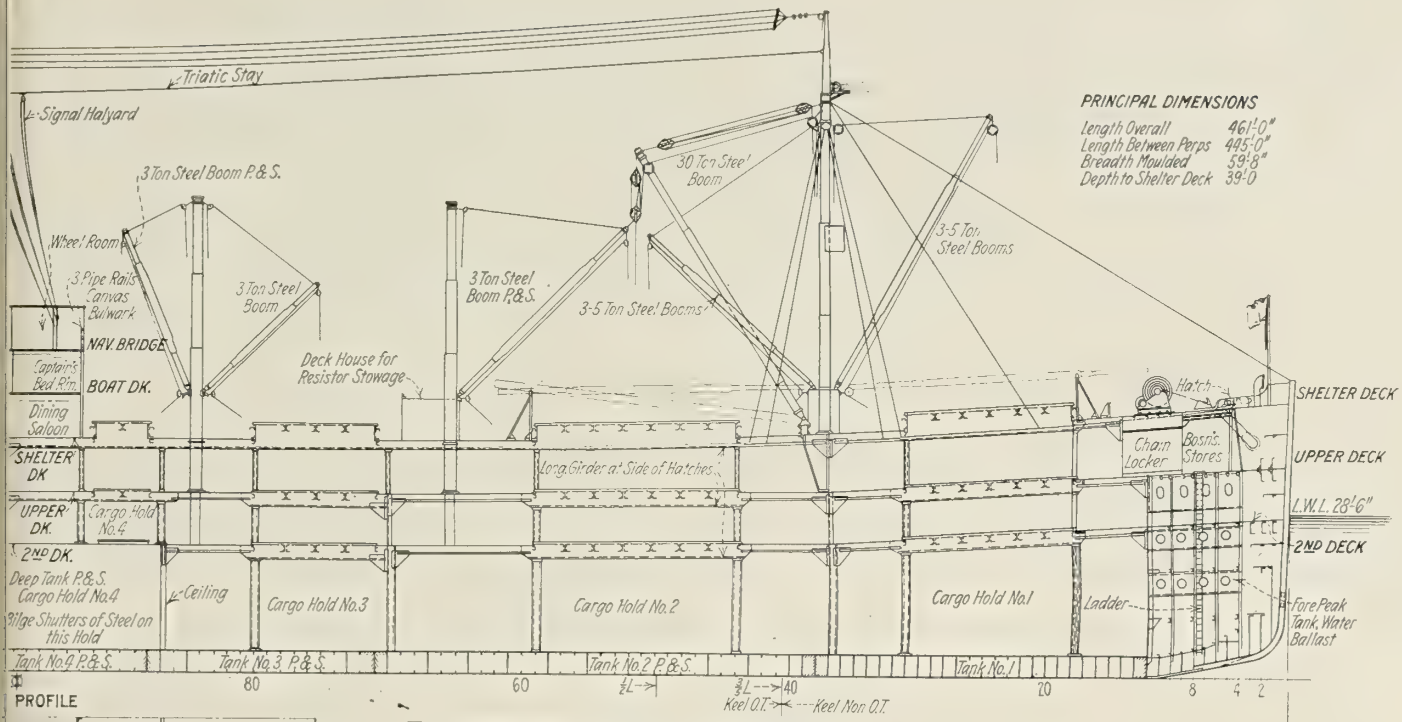
Auxiliary Machinery

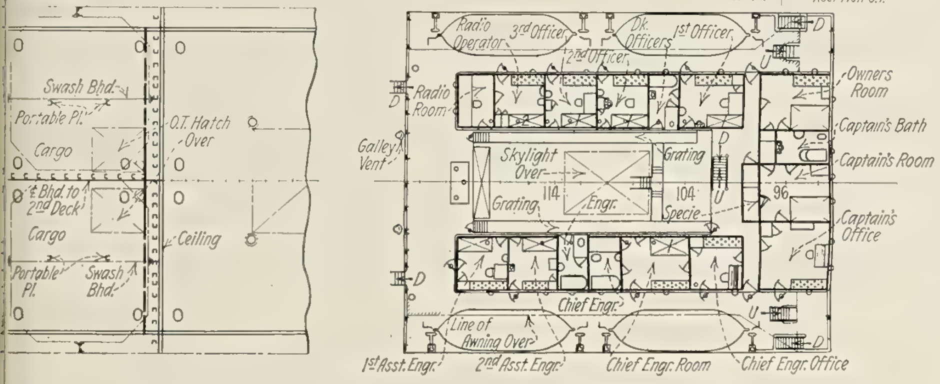
The auxiliary engines are of the typical Burmeister & Wain four cycle design, having two cylinders each. They are rated as 100 brake horsepower each, and are direct connected to 65 kilowatt direct current generators running at 300 revolutions per minute.

Three centrifugal cooling water pumps, arranged along the forward end of the engine room, supply salt water cooling to the main and auxiliary engines and maneuvering compressor, one being usually all that is required, with the other two as standbys. The water to the main engines divides on passing through the jackets of the compressors, part going

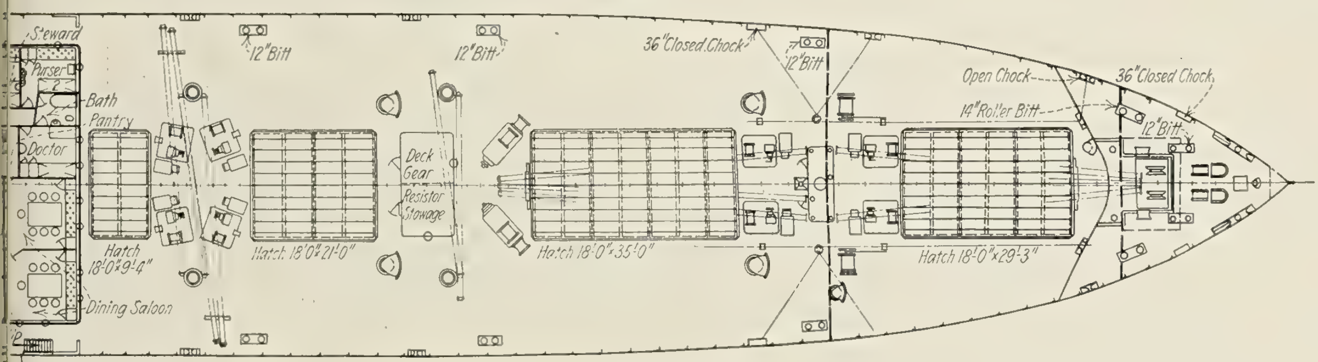


Profile and Deck Plans of Motor

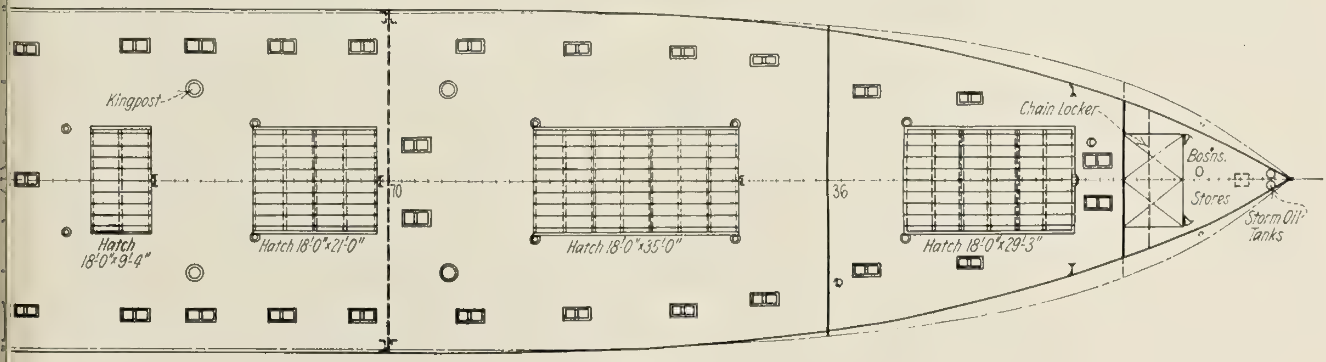




BOAT DECK

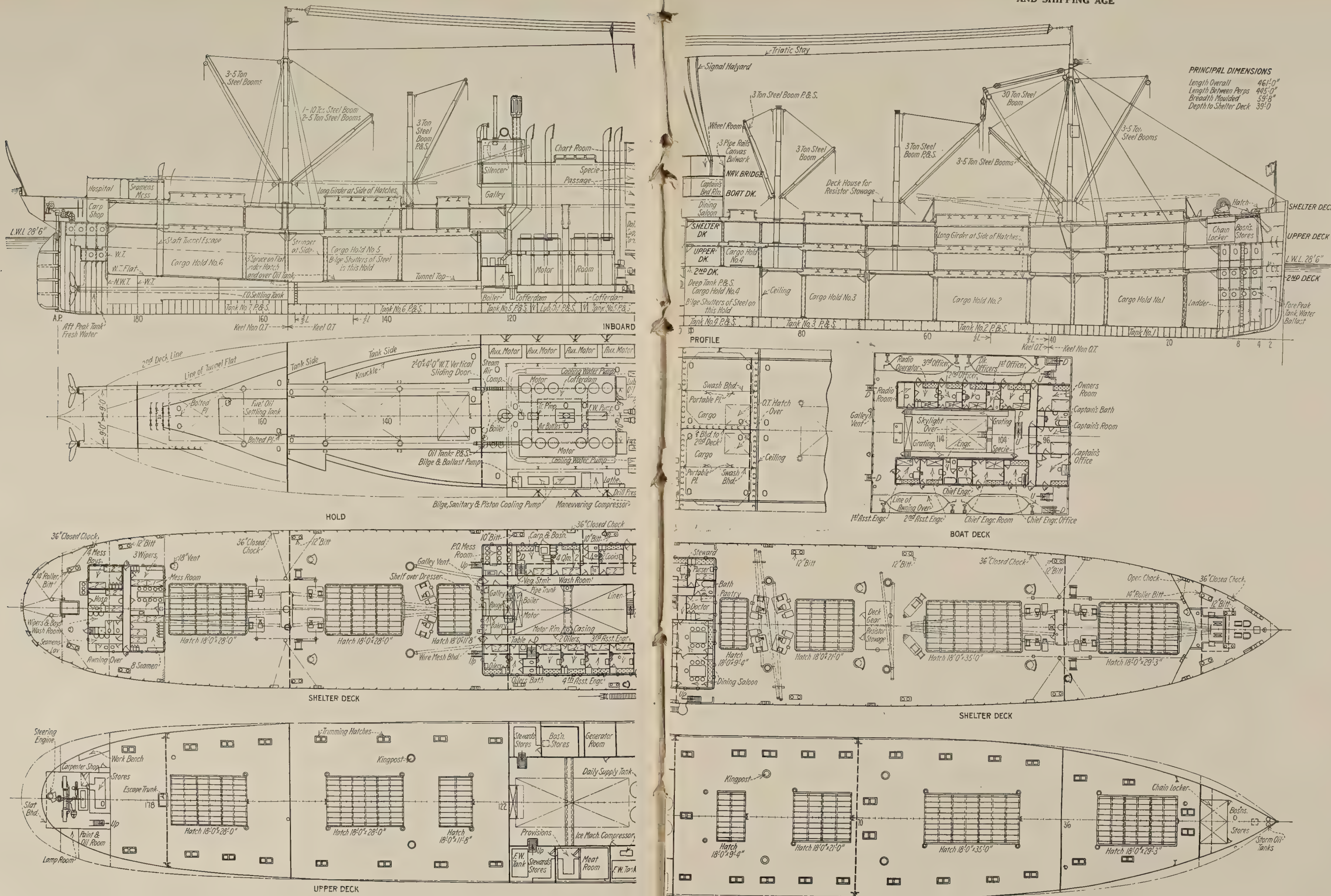


SHELTER DECK

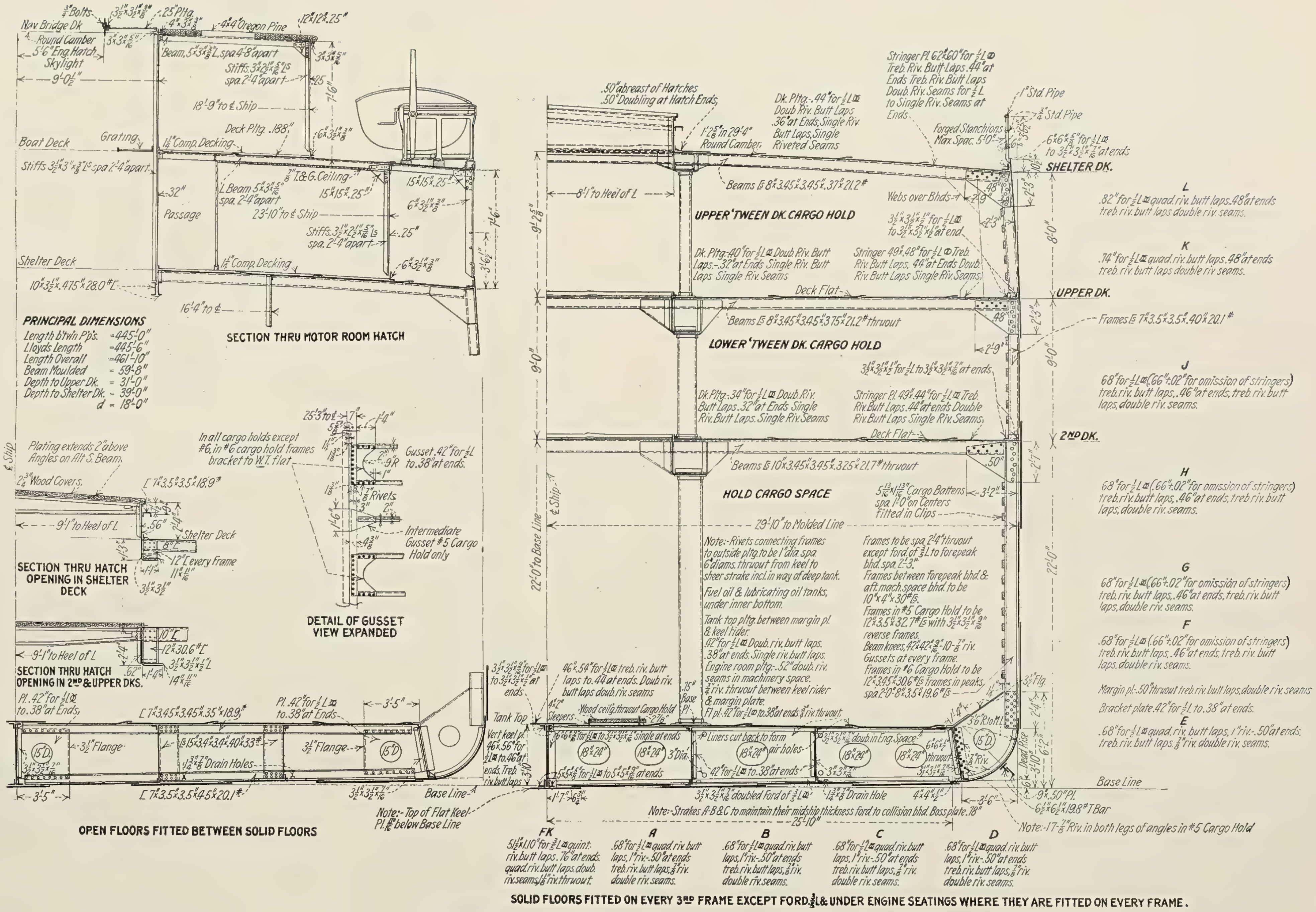


UPPER DECK

ips Californian and Missourian



Profile and Deck Plans of Motor Ships Californian and Missourian



Midship Section of Motorships Californian and Missourian

New American Motorship Californian and Missourian

General Information

Service: ....General freight

....

Builders: Hull: Merchant Shipbuilding Corp., Chester Pa.

Machinery: The Wm. Cramp & Sons Ship & Engine Bldg. Co., Phila., Pa., U. S., Licensees of Burmeister & Wain.

Owner: The American-Hawaiian Steamship Co.

Characteristics

Length, overall ....461′ 7½″
Length, B. P. ....445′ 0″
Breadth, molded ....59′ 8″
Depth, molded to shelter deck...... 39′ 0″
Draft, loaded ....28′ 6″
Draft, light ....10′ 7″
Block coefficient 0.76
Midship section coefficient 0.986
Longitudinal coefficient 0.77
Speed, loaded, knots 11.5
Cruising radius, nautical miles 25,000
Framing ....Transverse
Class .... ✠ 100 A.1. Lloyd's

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull, about 4,518
**Weight Propelling Machinery, about .982
Deadweight Capacity 11,000
Displacement 16,500

(In tons of 100 cubic feet)

Gross register ....
Net register ....

* Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.
** Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

2 bower anchors, stockless, each ..8,624 lbs.
1 bower anchor, stockless ....7,336 lbs.
1 stream anchor, stockless ....3,080 lbs.
1 kedge anchor, stockless ....1,400 lbs.
Cable, 2 7/16″ stud-chain .....300 fathoms
Streamline, 5″ steel wire ......120 fathoms
Towline, 5¾″ steel wire ......130 fathoms
4 hawsers, 8″ manila, each.....100 fathoms

Rudder

Area, square feet 191.4
Diameter Stock, upper,............... 12½″
Lower ....12″ to 9″
C. Press. abaft C. L. pintles, feet 3.6

Complement

Deck officers 4
Deck crew 14
Engineer officers 5
Engineer crew 9
Purser's and steward's department 7

Total officers and crew 39
First-class passengers } 3 spare rooms with
Second-class passengers } accommodations
Third-class passengers } for 5 persons
Total complement 44

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	pole	...	fore 78′ 0″; main 79′ 0″
Derrick posts	6	steel	....	41′ 0″
Booms.....	1	steel	30 ton	55′ 0″
	1	steel	10 ton	55′ 0″
	11	steel	5 ton	55′ 0″
	8	steel	3 ton	44′ 1″

Deck Machinery

Steering gear....Hyde windlass, Heleshaw, electric hydraulic type
Windlass..electric spur geared type, 75 H.P. motor.
Capstans.......(1) electric, reversible type
Winches....(16) 18x18 drum and (1) 18″ gypsy head, driven by 30 H.P. electric motors.

Life Saving Equipment

	No.	Capacity	Length
Lifeboats	3	30 persons	24′ 0″
Motorboat	1	....	24′ 0″

....
....

Propelling Machinery

Main Diesel Engines

Number 2
Type ....Cramp, B & W, 4 cycle
Size..............29⅛″ dia. x 45¼″ stroke
No. cylinders, each engine................6
R. P. M., designed.....................115
I. H. P., total.......................4,500

Auxiliary Diesel Engines

Number, (4) each direct connected to Diehl generators.
Type ....Cramp, B & W, 4 cycle
Size ....12¾″ diam. x 13¾″ stroke
No. cylinders, each engine..............2
R. P. M. 300
B. H. P., each 100

Donkey Boiler

Number 1
Type ....vertical firetube
Size.................48″ int. dia., 9′ 0″ high
Fuel ....oil
Heating surface, sq. ft..................400
Working pressure, lbs. per sq. in........150

Propellers

Number 2
Type..........solid mang. bronze, 4 blades
Weight ....
Diameter ....13′ 6″
Pitch ....11′ 9″
R. P. M. 115
Projected area, sq. ft....................51.1
Developed area, sq. ft.................59.35

Auxiliary Machinery

Machinery Space

Maneuvering compressor..(1) motor driven
Auxiliary compressor.....(1) steam driven
(1) F. W. cooler
Evaporators..(1) 500 gal. per day capacity
Distiller......(1) 500 gal. per day capacity
Filters ....
Feed water heater..........................
Fuel oil heaters...........................
Pumps ....
(3) S. W. cooling, centrif., motor dr.
(1) F. W. cooling, centrif., motor dr.
(2) Sanitary-bilge, plunger type, motor dr.
(1) Ballast, rotary, wing type, motor dr.
(1) Fuel transfer, rotary wing type, motor dr.
(2) Lub. oil, rotary gear type, motor dr.
(1) Fuel transfer, rotary gear type, motor dr.
(1) F. W. service, rotary gear type, motor dr.
(1) Donkey blr. fuel, 3 x 2 x 3 steam
(1) Donkey blr. feed, 5 x 3¼ x 5 steam
(1) Evap. feed, 3 x 3 x 3 steam

Refrigerating Machinery

Brunswick ammonia, direct expansion type, 2 tons capacity

....

Electric Equipment

Generators:
(4) 65 K.W. connect. to aux. Diesel eng.
(1) 20 K.W. motor generator set
Radio.......................2 K.W. outfit
Emergency..(1) 15 K.W. kerosene engine driven lighting set

Holds

No.	Length	Hatches
1 ..	56′ 3″	18′ 0″x29′ 3″
2 ..	76′ 8″	18′ 0″x35′ 0″
3 ..	39′ 8″	18′ 0″x21′ 0″
4 ..	28′ 0″	18′ 0″x9′ 4″
5 ..	72′ 4″	(1) 18′x11′ 8″ (1) 18′ 0″x28′ 0″
6 ..	67′ 8″	18′ 0″x28′ 0″

Capacities

Cargo Space

Compartment	Cu. ft. Grain	Cu. ft. Bales
Upper 'tween deck		
Hold No. 1	22,896	19,840
" " 2	79,181	70,864
" " 5	43,753	38,928
" " 6	33,745	30,032
Lower 'tween deck		
Hold No. 1	19,584	16,400
" " 2	39,211	34,400
" " 3	35,923	31,712
Hold No. 1	41,656	36,576
" " 2	77,486	70,544
" " 3	40,007	36,918
" " 5	110,634	100,592
" " 6	54,416	46,481
Total	598,492	533,287

Refrigerated Space

Compartment	Cu Ft.
Meat room	683
Provisions	594
Total	1,277

....
....
....

Fuel Oil Tanks

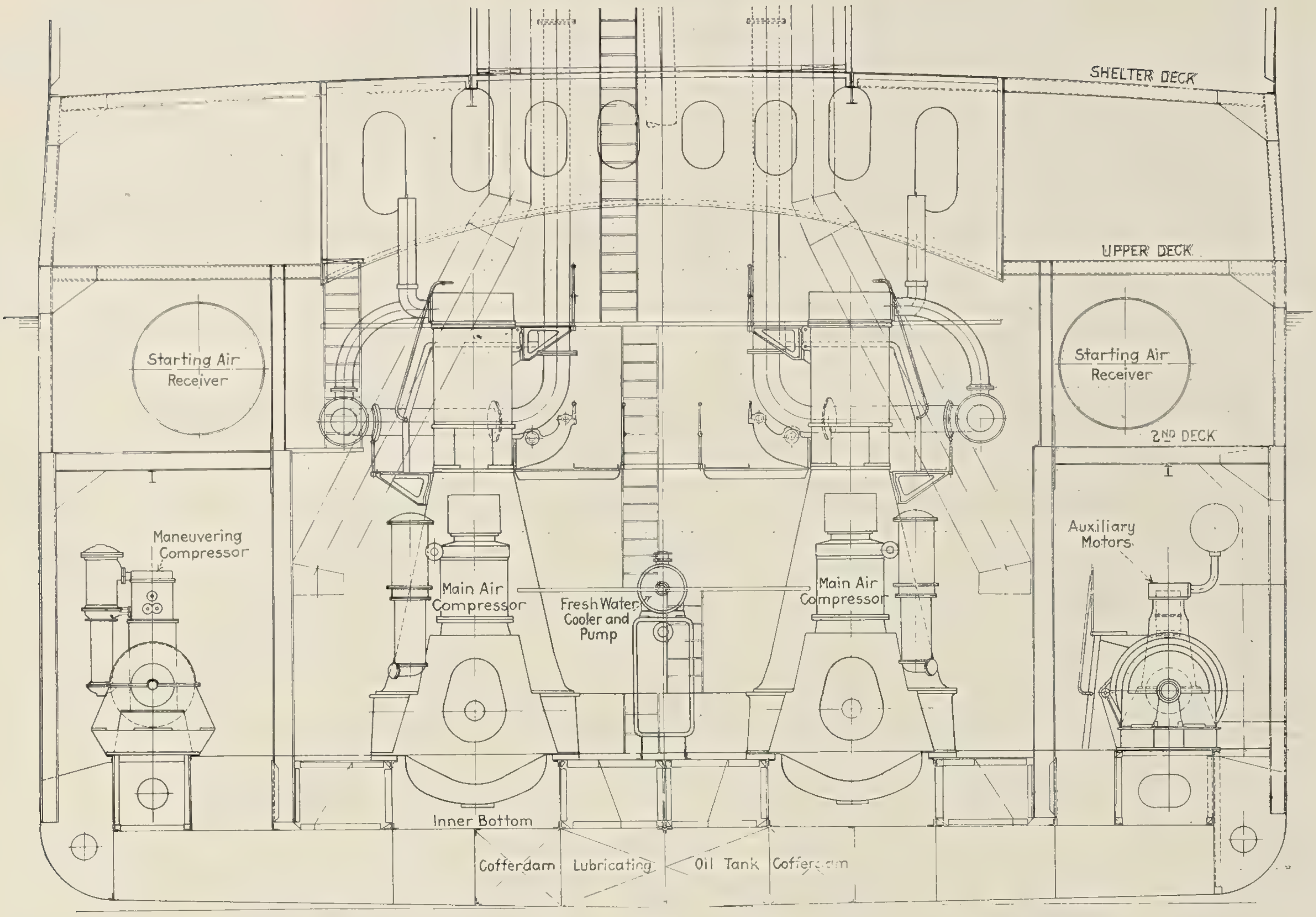
Compartment	Cu. Ft.	*Tons
I. B. tank No. 1..........	5,132	135.05
" " " 2 P. & S...	13,091	344.50
" " " 3 " ...	7,401	194.76
" " " 4 " ...	5,219	137.34
" " " 5 " ...	9,314	245.11
" " " 6 " ...	8,992	236.63
" " " 7 " ...	3,127	84.66
Settling tank	2,086	54.89
Daily supply tank........	837	22.02
Total	55,199	1454.96

....
....

*38 cu. ft. per ton;.............gals, per bbl.

Tanks

Compartment	Cu. Ft.	Tons F.W.	Tons S.W.
F. W. tanks (2)......	846	23.50	......
Aft. peak	6,474	184.97	......
Gravity	13.4	.37	......
I. B. tank No. 1......	5,132	....	146.62
I. B. tank No. 2, P. & S.	13,091	....	374.03
I. B. tank No. 3, P. & S.	7,401	....	211.46
I. B. tank No. 4, P. & S.	5,219	....	149.10
I. B. tank No. 5, P. & S.	9,314	....	266.11
I. B. tank No. 6, P. & S.	8,992	....	256.91
I. B. tank No. 7, P. & S.	3,127	....	89.34
Deep tank	30,610	....	874.57
Settling tank	2,086	....	59.60
Cofferdam	798	....	22.80
Lub. oil tank..........	586	....	16.74
Fore Peak.............	8,101	....	231.46
Total	101,790.4	208.84	2,698.74



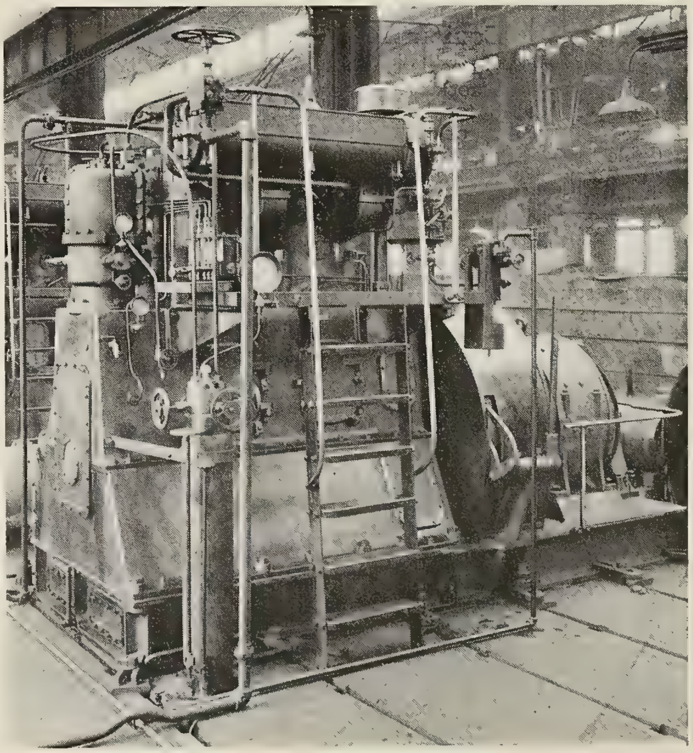
Section Through Machinery Space of Motorships Californian and Missourian

to cooling the thrust bearings, guides and pistons and part to the fresh water cooler from which it is discharged overboard by way of the jackets surrounding the exhaust manifolds. A fresh water closed cooling system is employed for the main engine jackets and cylinder covers, which arrangement has been recently adopted for deep draft vessels to guard against getting mud or sand into the system when navigating in rivers or passing through shallow waters. The circulating pump for circulating the fresh cooling water is located on top of the fresh water cooler.

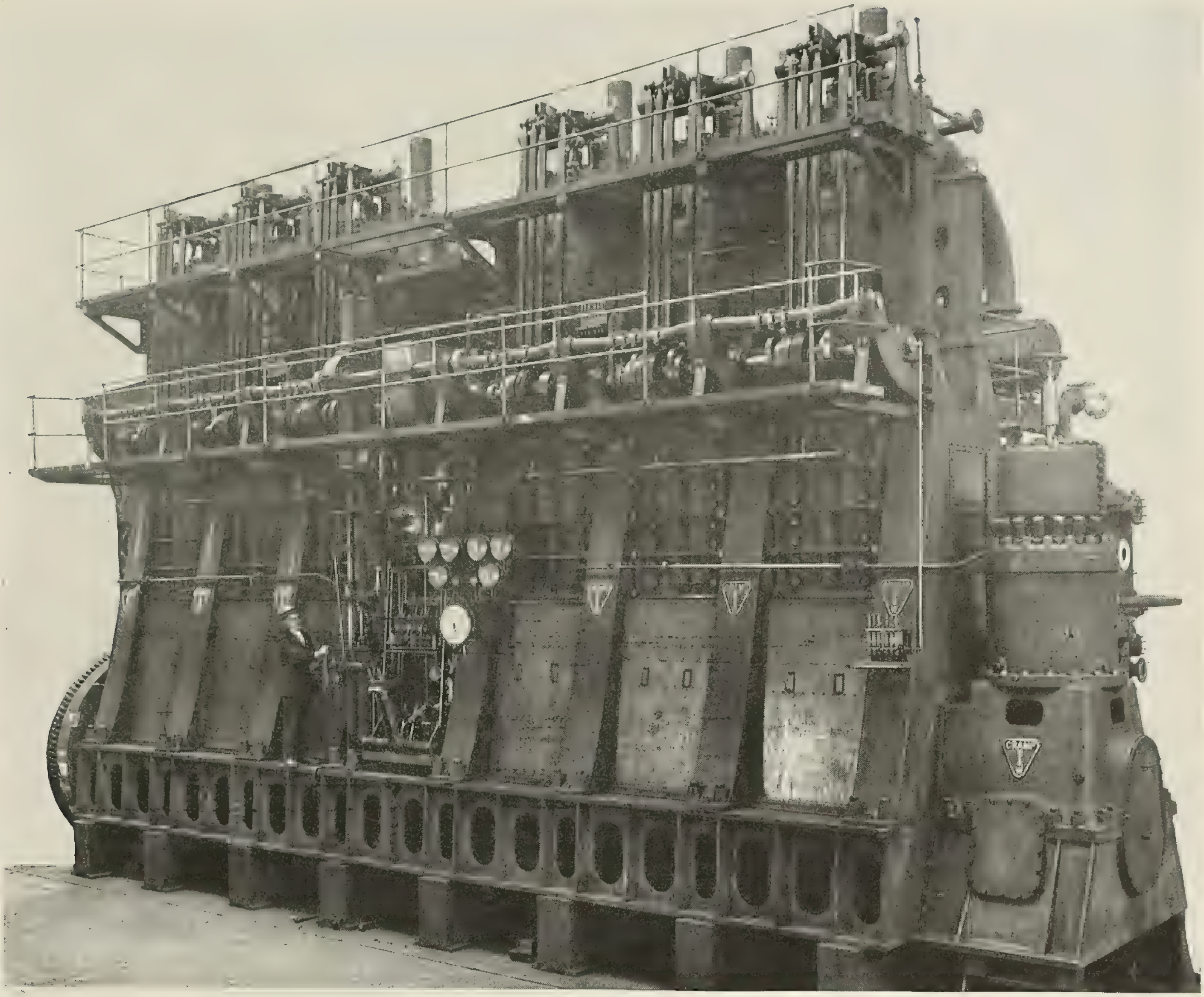
Two sets of lubricating oil pumps are provided for supplying oil under pressure to the main engines, one set being in operation at a time. Each consists of two gear type pumps driven by a common motor and so arranged that each supplies oil independently to one of the engines. The oil drains from the main engines to two separate settling tanks, built into the double bottom of the ship, from which the pumps draw, discharging through strainers to the pressure lubricating systems.

A fuel oil transfer pump, also of the gear type, is used for general oil transfer purposes and for pumping up the daily supply tanks. These latter, which in addition act as settling tanks, are placed on a platform on the forward engine room bulkhead and are of sufficient capacity each for 12 hours running. A small tank is used for a lighter grade of oil for starting up and closing down the auxiliary engines should the main supply be fairly heavy.

A two-stage air compressor, driven by a 120 horsepower motor, and operated when maneuvering is to be done, delivers air at 350 pounds pressure to the starting air receivers located on the port and starboard sides. This compressor also takes the place of a reserve compressor should one of the main engine compressors be out of commission. In such an event the high pressure cylinder of the main engine compressor not disabled draws air from the starting air system and supplies injection air to both engines. The usual losses



One of the Auxiliary Engines



One of the Main Diesel Propelling Engines of the New American Motorships

in maneuvering air when at sea are made up by air taken from the main engine compressors. There is also a small steam driven compressor for pumping up one of the auxiliary engine air bottles when the vessel is new, or should all air on board be lost accidentally.

Two three-throw plunger pumps are for sanitary and fire, general bilge service and for removing the piston cooling water which is dropped into a well in the engine bilge after being discharged from the pistons. One pump is kept as a spare, except in case of fire, when both are employed.

The ballast pump is of the wing type with a capacity of 150 tons per hour.

A small donkey boiler of the fire tube type with 400 square feet of heating surface is installed in the thrust recess for furnishing steam for heating, for operating the small reserve compressor and for fire extinguishing purposes. A CO_2 smothering system is also installed and arranged to work in common with the steam system.

A motor generator set of 20 kilowatts capacity changes the 220 volts to 110 volts for lighting purposes. A 15-kilowatt kerosene engine driven lighting set is installed on the main deck as a reserve lighting set and for operating in port when it is desired to close down the engine room completely.

Provision is made in the silencer house for heating salt and fresh water for sanitary purposes from the exhaust gases from the main engines.

Weight of Machinery

The total weight of the two main engines with flywheel, attached piping, grating and exhaust manifolds is 543 tons. The total weight of machinery within the engine room, including shafting, etc., and deck silencers, with water but excluding hull engineering piping, etc., is 932 tons.

The contract speed of the vessels is 11.5 knots loaded, though it is anticipated that 12 knots will easily be made, which is to be assumed from the performance of similar sized foreign vessels having similar block coefficients and the same size engines.

No effort has been spared in obtaining for these ships the best in workmanship and material, and in the selection of auxiliaries, so that when they go into service it is expected that they will rank with the best freighters in the world in economy and reliability.

The size and tonnage of these motorships are the outstanding features for economical service and they are considered the most acceptable type for the establishment and maintenance of long distance voyages for combined cargo-passenger trade routes.

It is encouraging to note that American shipowners are beginning to appreciate the economy of motorships for long voyages and are taking steps to place the American merchant marine in a position to meet foreign competition in this respect.

The Motor Liner Domala, of 11,000 Tons Deadweight Carrying Capacity and 13¾ Knots Speed

Motor Passenger Liner Domala

First Oil Engined Vessel Specially Designed for Carrying Passengers—Radius of Action Over 13,000 Miles

By Our Special London Correspondent

ALTHOUGH the motor ship *Aba,* which sailed on her maiden voyage in November, was the first passenger liner equipped with internal combustion engines, she was not originally constructed for this purpose and was, in effect, a converted cargo ship. The *Domala,* however, which left London on December 30 for her first trip, was designed in the first instance as a passenger liner. As she is the first ship built for the British India Steam Navigation Company, her completion has aroused enormous interest. This firm owns some 50 steamers, and is affiliated with the Peninsular and Oriental Steam Navigation Company. It may therefore reasonably be anticipated that, if the *Domala* proves successful in service, she will be followed by still larger motor mail liners on the Peninsular and Oriental service between London and India.

Popular Line With Passengers and Shippers

The *Domala,* except for her machinery, is similar in design and appearance to a number of steamers built for the same owners. These have always proved extremely popular vessels, both with passengers and shippers, as the voyage from London to Bombay takes only a few days longer than the mail steamer, while the price is £10 lower. Passenger accommodation is all amidships, comprising cabins for 41 second class and 85 first class passengers, although arrangements are made by which some of the two berthed first class rooms can be turned into three berthed second class, if desired, increasing the total passenger accommodation to about 140. The engine room is arranged amidships and it is a proof of the quietness and absence of vibration of modern Diesel machinery that the passenger accommodation is all above the machinery, which would not have been allowable were vibration or noise excessive.

Larger Deadweight Carrying Capacity

The total length of the engine room exclusive of the thrust recess is 56 feet and, although, owing to the adoption of the four cycle system, the engines are large and heavy, the overall length occupied is less than that required in a corresponding reciprocating steam engined vessel including the boilers and cross bunkers. The actual machinery weighs approximately the same as a steam plant of similar power, but a considerable additional space is available for cargo, as the fuel oil is carried in tanks in the double bottom, forward of the engine room. For a given radius of action (which is over 13,000 miles in the case of the *Domala*) the weight of oil required is one quarter of that in a coal fired steamer, so that the deadweight capacity of the motorship is larger.

Electro Hydraulic Winches

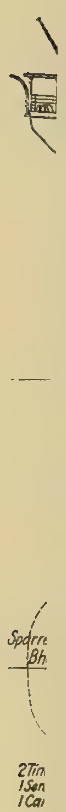
Of the six holds, varying in length from 49 feet 6 inches to 60 feet 6 inches, three are arranged forward, and three aft of the engine room, served by 12 three-ton winches of the electro hydraulic type. Winches of this class are very uncommon, the advantage claimed being that any speed of lifting is possible from the maximum to a "creep," and that the control is much better than is possible with electric winches provided with ordinary contactor switches. They are of the Williams Janney design, the same principle that is now frequently adopted for electric hydraulic steering gears. It involves a hydraulic pump which is driven by an electric motor. The whole of the control of the winch is effected on the pump itself so that the motor operates continuously.

These winches are more expensive to install than the direct gear driven type but the manufacturers state that the cost of upkeep is less, the consumption smaller and they are simpler to manipulate by the natives who operate the cargo handling appliances on the eastern run. There are six hatches each provided with two winches.

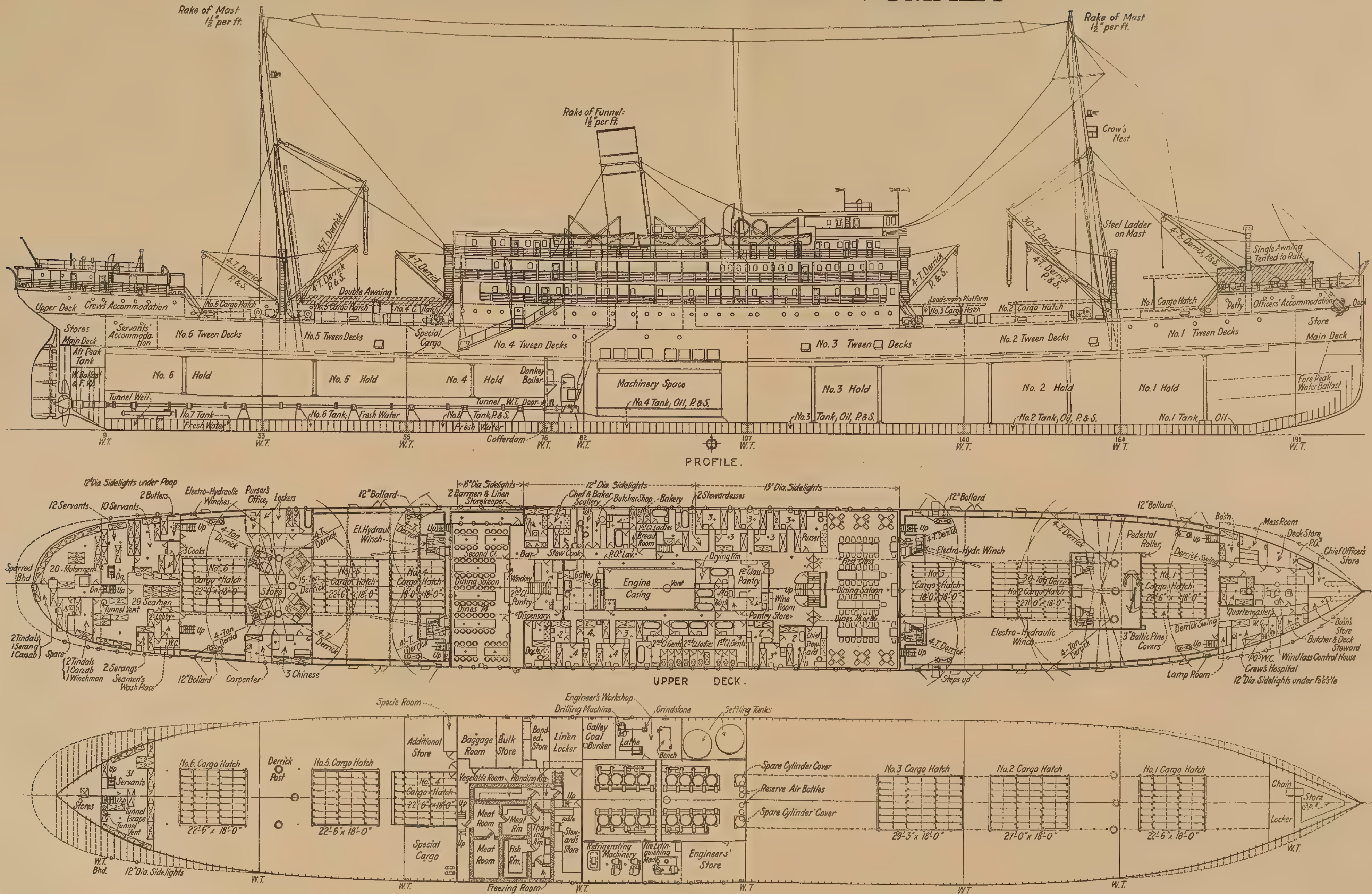
Construction of Hull

The hull of the *Domala* was built by Barclay Curle and Company, Limited, on the Clyde, and has the following dimensions: Length overall, 465 feet; length between per-

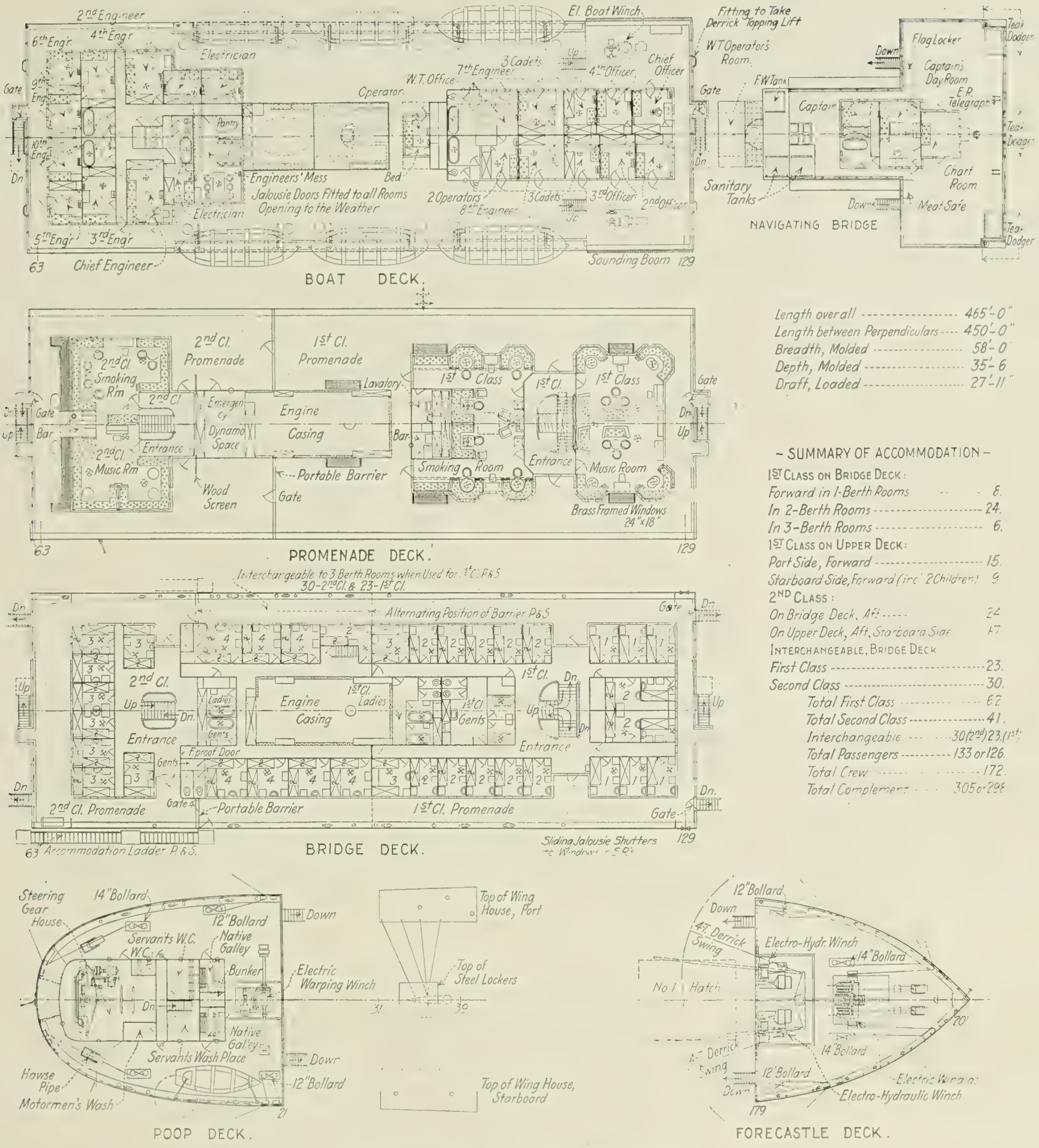
MAF



MOTOR PASSENGER LINER DOMALA



Profile and Deck Plans



Upper Deck Plans of Motorship Domala

pendiculars, 450 feet; breadth molded, 58 feet; depth molded, 35 feet 6 inches; draft, 27 feet 11 inches. The gross tonnage is just under 9,000 and the deadweight capacity about 11,000 tons.

A large proportion of the crew, which totals 172 people, is composed of natives, quartered in the poop, while the European petty officers have cabins in the forecastle. Lord Inchcape who is chairman of the British India Steam Navigation Company, holds strongly to the view that engineers and deck officers should have the best possible accommodation and moreover that they should be located on the same deck. In the *Domala,* therefore, both the engineers and the navigating officers are berthed on the boat deck, the former at the after end and the latter forward, a separate room being provided for each deck officer. It is to be noted that by this system, the engineers and deck officers have a large space for recreation purposes, exclusive of the passenger deck.

Main Deck Arrangement

On the main deck, aft of the engine room, are various refrigerated chambers cooled on the carbon dioxide system and, in addition, the baggage room, linen locker and stores for other purposes. On the upper deck immediately above are a number of first and second class cabins, with the first

Motor Passenger Liner Domala

General Information

Service: England-India Freight and Passenger

Builder: Barclay Curle & Co., Ltd., Whiteinch, Glasgow

Owner: British India S. N. Co., Ltd., London

Characteristics

Length, overall	465′-0″
Length, B. P.	450′-0″
Breadth, molded	58′-0″
Depth, molded	35′-6″
Draft, loaded	27′-11″
Draft, light	
Block coefficient	
Midship section coefficient	
Longitudinal coefficient	
Speed, loaded, knots	13.5
Cruising radius, nautical miles	13,300
Framing	Transverse
Class	100 A.1. Lloyds

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	
**Weight Propelling Machinery	
Deadweight Capacity, approx	11,000

Displacement

(In tons of 100 cubic feet)

Gross register, about	9,000
Net register	5,200

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez / Panama	Not yet available.	

Equipment

Anchors / Chain ... to Lloyd's Rules

Rudder

Area	
Dia. Stock	
C. Press. abaft C. L. pintles	

Complement

Deck officers	5
Deck crew	49
Wireless operators	3
Engineer officers	13
Engineer crew	24
Purser's and steward's department	78
Total officers and crew	172
First-class passengers	62
Second-class passengers	41
Interchangeable...30 (2nd cl.) or 23 (1st cl.)	
Total passengers	133 or 126
Total complement	305 or 298

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	Pole	....	....
Derrick posts	5		....	....
Booms	12		4-ton	....
Booms	1		15-ton	....
Booms	1		30-ton	....

Deck Machinery

Steering Gear	Hele Shaw, electric type
Windlass	(1) electric
Capstans	None
Winches	(13) electro-hydraulic

Life Saving Equipment

	No.	Capacity	Length
Lifeboats	2	60 persons	30′-0″
Lifeboats	4	50 persons	28′-0″
Dinghy	1		20′-0″

Donkey Boilers

Number	1
Type	vertical
Length	
Width or Diameter	
Furnaces	
Fuel	Oil
Draft	
Total heating surface, square feet	220
Total grate surface or furnace volume	
Superheat, degrees F.	
Working pressure, lbs. per sq. in.	100

Normal fuel consumption:

Per day, tons	1.00
Per horsepower hour, pounds	

Normal steam production:

Per hour per pound of fuel	lbs.
Total per hour	lbs.

Propelling Engines

Number	2
Type	North British Diesel
Size	8 cylinders, 26.5″ x 47″
Horsepower, total indicated	4,660

Propellers

Number	2
Type	4 bladed
Weight	
Diameter	
Pitch	
R. P. M.	
Projected area	
Developed area	

Auxiliary Machinery

Machinery Space

Air Compressors (2) Diesel-driven.
(2) Aux. air compressors.
(1) Steam-driven air compressor.
Evaporators (1) 3,000 gals. per 24 hrs.
Distiller (1) 3,000 gals. per 24 hrs.
(1) F. O. Plant for donkey boiler.
(1) Silencer.
(1) Oil cooler.
(1) DeLaval oil separator.
(1) Clayton fire ext. machine.
(6) Portable fire exting'rs.
(6) Foamite firefoam exting'rs.
(1) Exh. heat boiler.
(1) Exh. heat boiler injector.
(1) Blake boiler injector.

Pumps

(1) 30″ Sirocco fan.
(1) Ballast.
(2) Lubricating oil.
(1) Daily service fuel oil.
(2) Cylinder cooling water.
(2) Bilge.
(1) Piston cooling water.
(1) Cold sanitary.
(1) Hot sanitary.
(1) Donkey feed.
(1) Emergency bilge.
(1) Hand lubricating oil.
(1) Hand F. O. drain.

Refrigerating Machinery

Haslam electrically-driven CO_2 machine.

Electric Equipment

Generators:
(2) 215 K. W. units.
(1) Tuxham engine, dynamo and tanks.
Emergency 16 K. W. unit.

Holds

No.	Length	Hatches
1	60′-6″	22′-6″ x 18′-0″
2	54′-0″	27′-0″ x 18′-0″
3	74′-6″	29′-3″ x 18′-0″
4	61′-0″	22′-6″ x 18′-0″
5	49′-6″	22′-6″ x 18′-0″
6	54′-0″	22′-6″ x 18′-0″

Capacities

Cargo Space

Compartment

Refrigerated Space

Compartment	Cu. Ft.

Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons
Oil fuel in double bottom in four tanks.			

*....cu. ft. per ton; ....gals. per bbl.

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Total			

class dining saloon at one end and that for the second class at the other. In both cases, seating accommodation is provided for more than the full complement of passengers, mainly at small tables.

All of the cabins, on this and the other decks, are provided with a port hole. An examination of the plans will show that in the case of the interior cabin this has been carried out in a very ingenious manner by leaving a passageway between the two outer cabins. In this way, a certain amount of space is lost but there is undoubtedly an overwhelming advantage in its favor. The system was introduced by Lord Inchcape and a somewhat similar method is adopted on certain other British passenger liners.

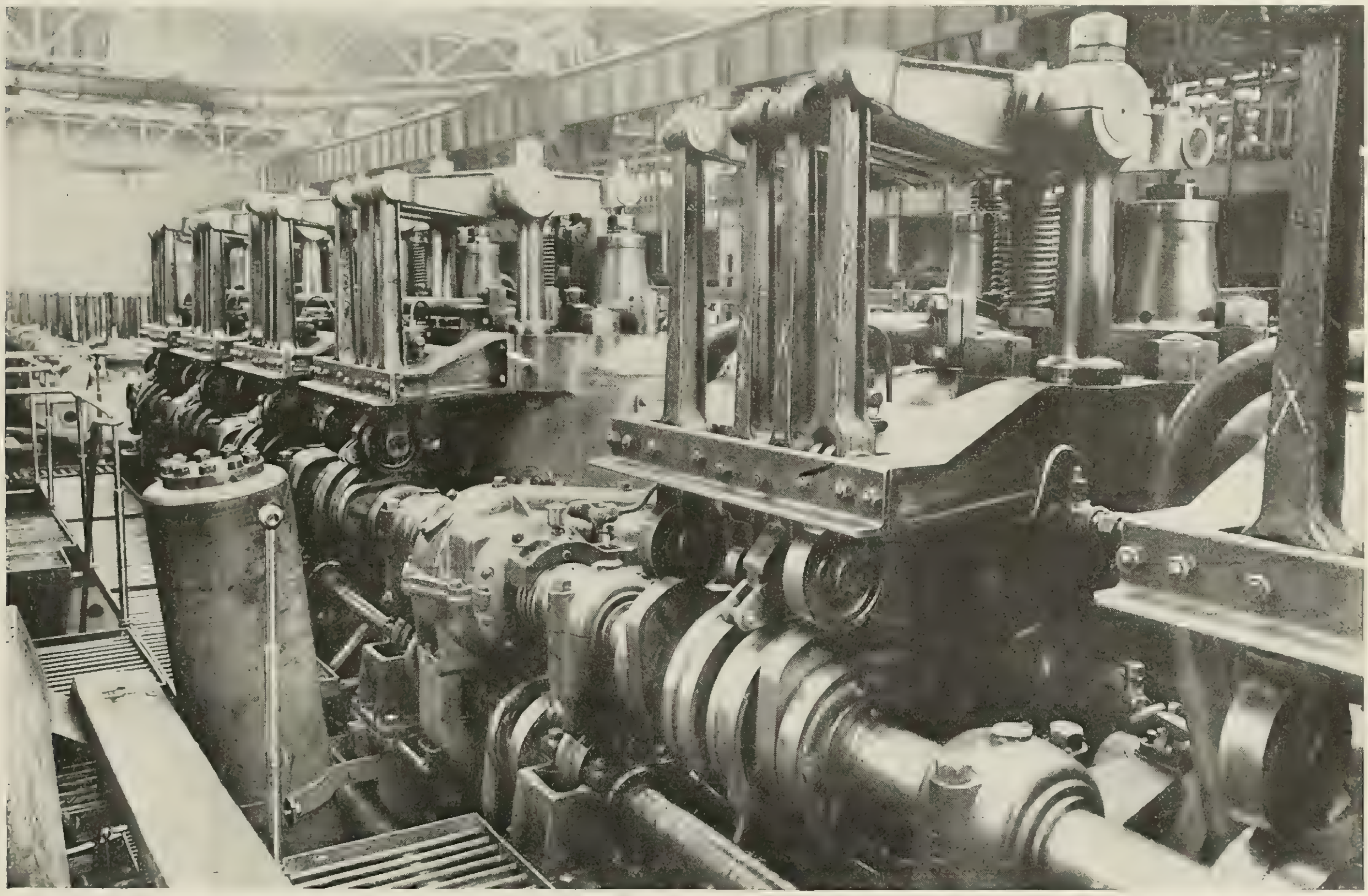
Galley Features

The galley is situated on the main deck aft of the engine casing. An interesting feature is that there is a passageway from the galley to the dining saloon inside the main passageway so that the movement of the passengers is not impeded by the dining saloon attendants. This again means a certain loss of space but it has obvious advantages. The dining saloons and other public rooms are heated by electric radiators but the galley is coal fired, while hot water for the boiling vessels, etc., is supplied from a donkey boiler in the engine room.

Above the main deck is the bridge deck with further passenger accommodation, many of the cabins at the forward end being provided with a single bed. Above this is the promenade deck, with the first class entrance dividing the music saloon from the smoking room, while at the after end of the same deck is the second class smoking room and the music room. The boat deck, as previously mentioned, has accommodation for the officers and engineers. Above the navigating bridge are the captain's dayroom and bedroom. All of the cabins are provided with running water with overboard discharge, a convenience realized only by the experienced traveller. An electric fan is fitted in each room, large ceiling fans being provided in the public rooms.

Machinery Installation

The machinery installation represents the first of its class that has yet been installed in any vessel and is a twin screw plant developing a total of 4,000 brake horsepower, which on trials gave the vessel a speed of 13¾ knots. It was built by the North British Diesel Engine Works in Glasgow and each engine has eight cylinders, 26½ inches diameter and 47 inches stroke. When running at 96 revolutions per minute the full power (which is equivalent to about 2,350 indicated horsepower) is developed, but it is to be noted that although the engines are of the usual air injection type, they do not drive their own air blast compressors.

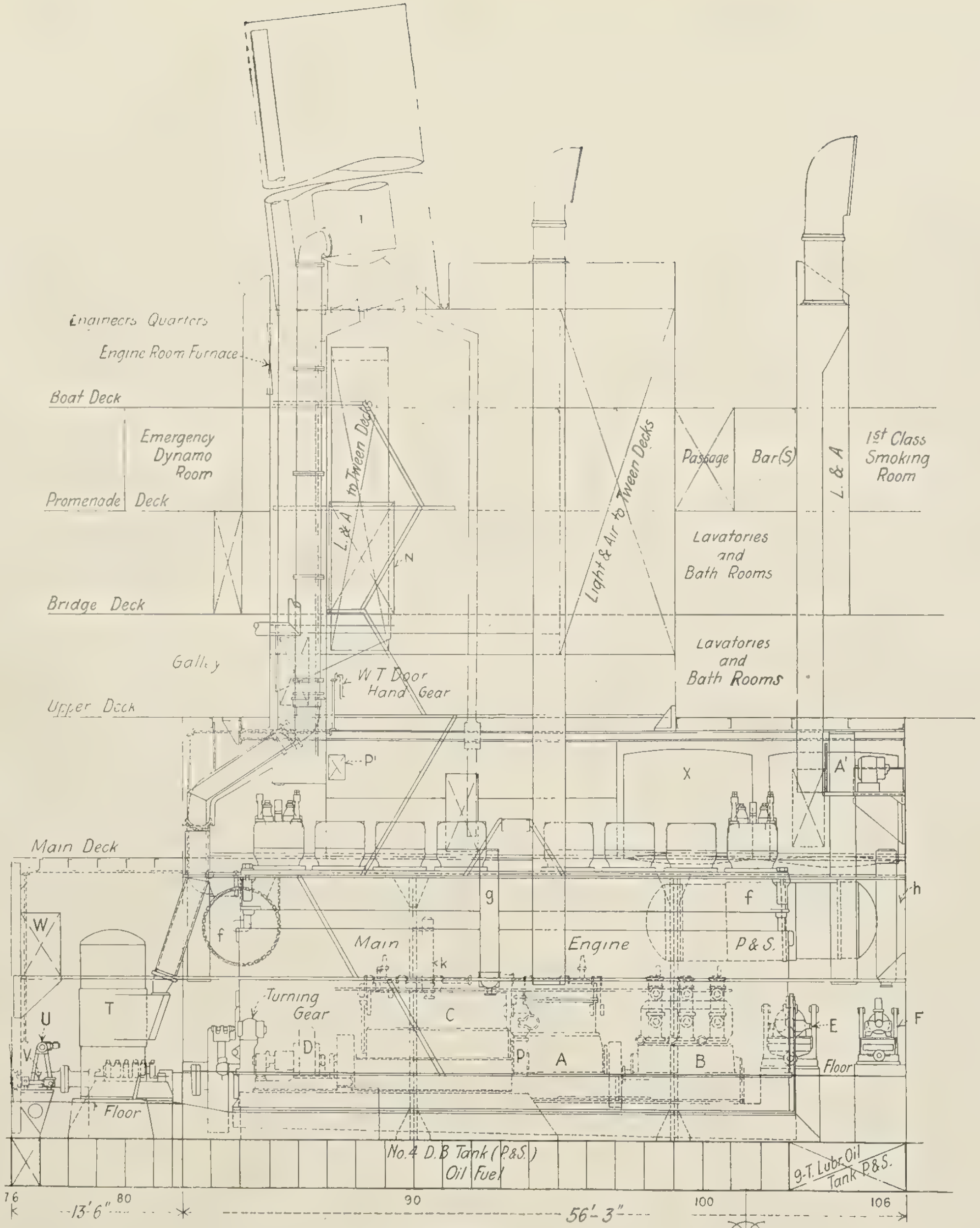


Top of One of the 2,000 Brake Horsepower Engines of the Domala, Showing Valve Operating and Reversing Mechanism

New Design Features

Each engine is some 44 feet in length overall and arranged in two groups of four cylinders, with the reversing mechanism in the center. Apart from the Burmeister and Wain and Worthington types, no four cycle Diesel marine motors of larger size have yet been constructed and in the design one or two novel features have been introduced. On the top of the cast iron frames, which do not take the cylinder stresses, is carried an entablature which supports the cylinders. Long vertical steel columns pass from the bedplate to the top of this entablature and relieve the framing of the stresses, the construction in this respect being somewhat similar to that employed with the newest Burmeister and Wain engine.

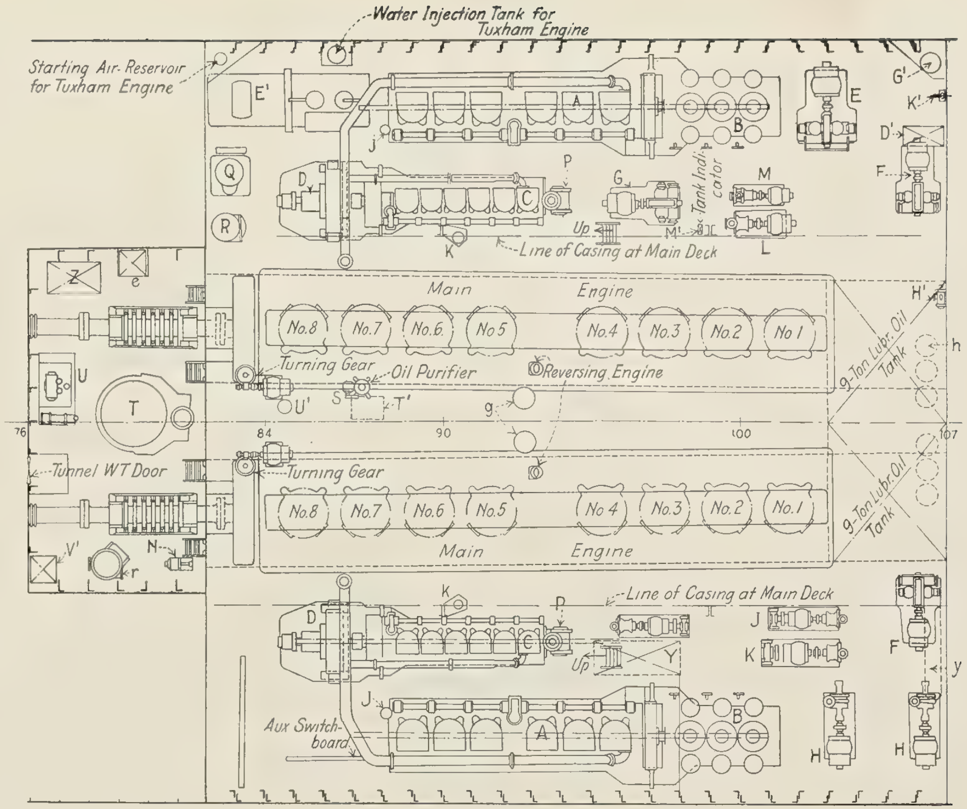
A marked difference is, however, to be noted in the valve



ELEVATION

LIST OF AUXILIARY MACHINERY, ETC.

Mark	No.	Description	Size
A	2	Compressor engine	6 cyl., 15″ dia. by 17¾″ stk.
B	2	Main air compressor	1,000 cu. ft. per min.
C	2	Dynamo engine	6 cyl., 11½″ dia. by 14½″ stk.
D	2	Dynamo	215 k.w.



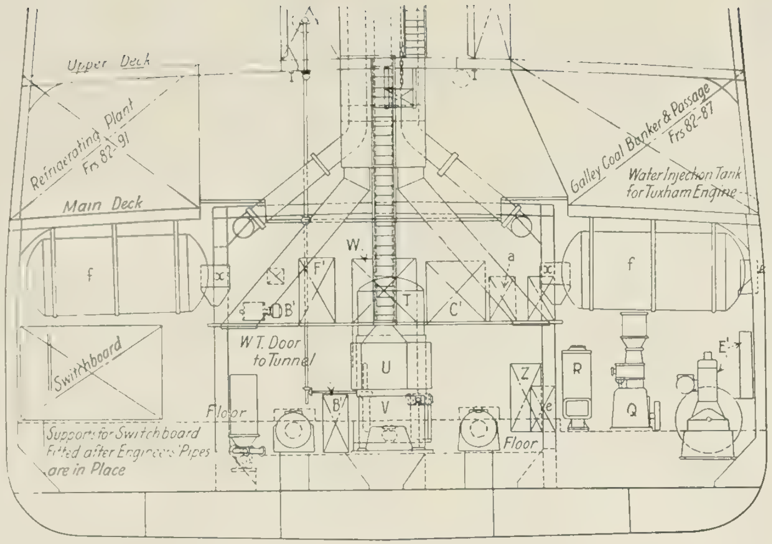
PLAN

List of Auxiliary Machinery, etc., Continued.

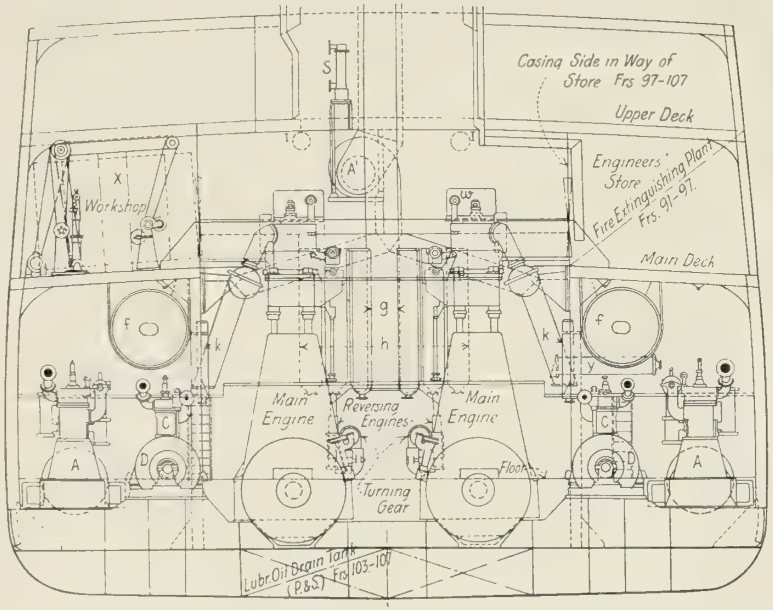
Mark	No.	Description	Size
E	1	Ballast pump	100 tons per hr.
F	2	Lubricating oil pump	50 tons per hr.
G	1	Daily service o. f. pump	50 tons per hr.
H	2	Cyl. cooling water pump	150 tons per hr.
J	2	Bilge pump	50 tons per hr.
K	1	Piston cooling water pump	100 tons per hr.
L	1	Cold sanitary pump	80 tons per hr.
M	1	Hot sanitary pump	30 tons per hr.
N	1	Fresh water pump	10 tons per hr.
P	2	Aux. air compressor	....
Q	1	Steam air compressor	60 cu. ft. per min.
R	1	Evaporator	3,000 gals. per 24 hrs.
S	1	Distiller	3,000 gals. per 24 hrs.
T	1	Donkey boiler	H. S. = 220; W. P. = 100 lbs. per sq. in.
U	1	Donkey boiler o. f. plant	....
V	1	Donkey boiler feed pump	....
W	1	Donkey boiler feed tank	2 tons
X	2	Daily service o. f. tanks	14 tons each
Y	1	Piston cooling water tank	2 tons
Z	1	Reserve lub. oil tank	1½ tons
a	3	Eng. oil tanks	80 gals. each
b	2	Cyl. oil tanks	80 gals. each
d	1	Colza oil tanks	80 gals.
e	1	Paraffin oil tanks	80 gals.
f	4	Starting air receivers	1,510 cu. ft. (total)
g	2	Main eng. air bottles (working)	17″ ex. dia. by 134″ long
h	6	Reserve air bottles	19″ ex. dia. by 127″ long
i	2	Compressor eng. air bottles	10½″ ex. dia. by 87″ long
k	3	Dynamo air bottles	10½″ ex. dia. by 74″ long
l	1	Silencer	....

List of Auxiliary Machinery, etc., Continued.

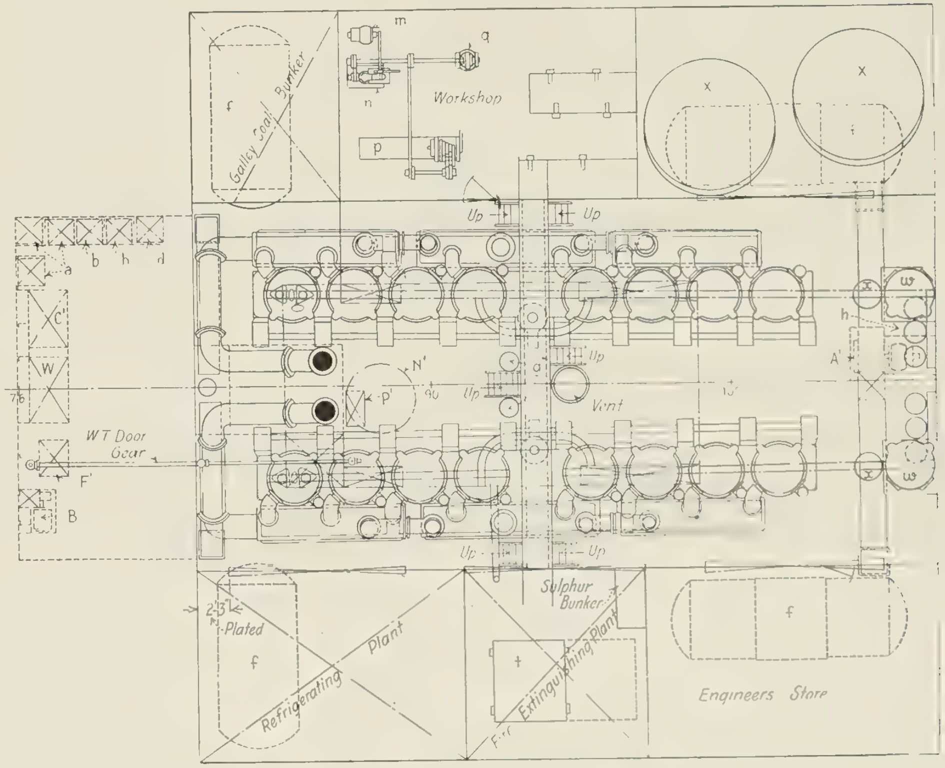
Mark	No.	Description	Size
m	1	Workshop motor	....
n	1	Drilling machine	....
p	1	Lathe	....
q	1	Grindstone	....
r	1	Emergency bilge pump	100 tons per hr.
t	1	Clayton fire extinguishing machine	....
w	2	Spare cyl. covers	....
x	2	Spare pistons	....
y	1	Oil cooler	....
A^1	1	Sirocco fan	30" dia. fan
B^1	1	W. t. door and gear	....
C^1	1	Lub. oil settling tank	1½ tons
D^1	1	F. o. drain tank	105 gals.
...	6	Portable fire extinguishers	....
E^1	1	Tuxham engine, dynamo and tanks	44 k.w. dynamo
F^1	1	Observation tank	200 gals.
G^1	1	O. f. drain water tank	65 gals.
...	6	Foamite fire foam extinguishers	2 gals.
H^1	1	Hand lub. oil pump	....
K^1	1	Hand pump for o. f. drain	....
M^1	2	Teledep indicator	....
N^1	1	Exhaust heat. boiler	4' 6" dia. by 7' 10⅝" long; total heat. surf. 1,070 sq. ft.
P^1	1	Exhaust heat. boiler feed tank	60 gals.
O^1	1	Exhaust heat. boiler feed injector	Size 5, bore 1"
R^1	1	Blake boiler injector	Size 3½, bore ¾"
S^1	1	De Laval separator	100 to 120 gals. per hr.
T^1	1	De Laval separator tank	65 gals.
U^1	1	Drain tank for aux. boiler saveall	5 gals.
V^1	1	Sand tank	8 cu. ft.



SECTION LOOKING AFT



SECTION LOOKING FORWARD

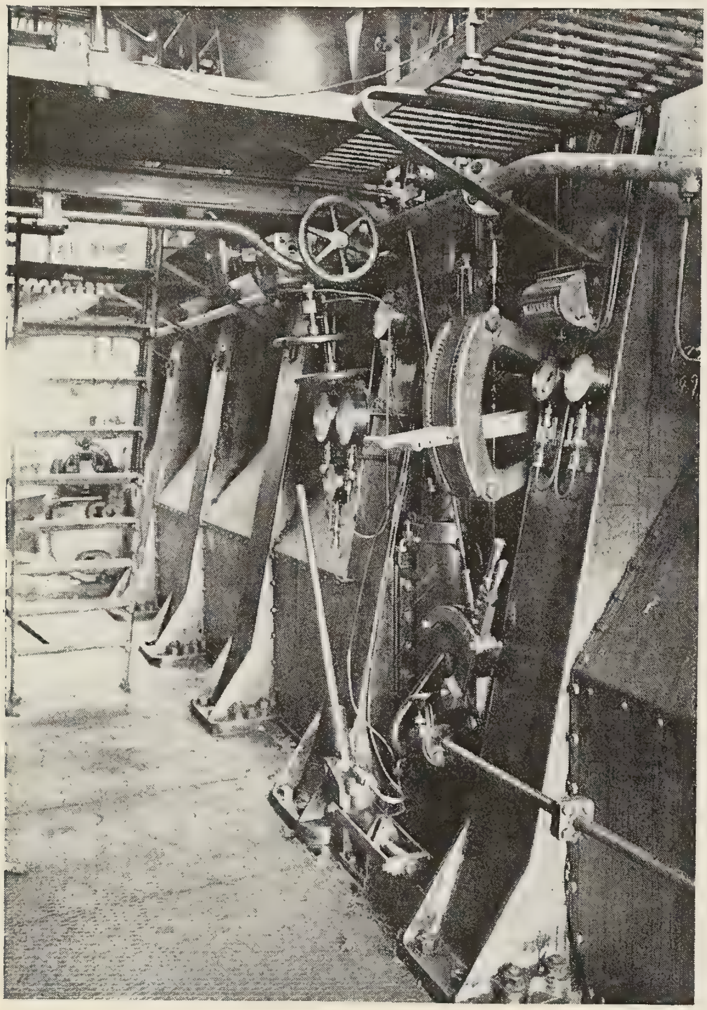


PLAN AT MAIN DECK

Machinery Arrangement of Motorship Domala

operating and reversing mechanism, which is quite novel. There are eight cams on the camshaft for actuating the four valves in each cylinder, one set for ahead and the other for astern running. The movement of the valves is effected through push rods and horizontal rocking levers. When it is required to bring the astern cams into action, the servo motor controlled from the starting platform causes the camshaft to be lowered and then moved in a longitudinal direction so as to bring the astern cams into position. The camshaft is then raised and the mechanism is correctly timed for running astern.

The heavy bedplate of the engine is of box section and is in four parts. The comparatively light frames mentioned



Control Station of One of the 2,000 Brake Horsepower Engines on the Domala

above carry the crosshead guides. The piston cooling water reaches the piston head through a hole in the piston rod. Sea water is used for piston and for cylinder cooling but separately driven electric pumps are provided in the engine room for this purpose, the pressure of the piston cooling water being somewhat above that of the circulating water used for the cylinders and cylinder covers. The eight fuel pumps are driven from a spur wheel on the vertical shaft, transmitting the crankshaft motion to the camshaft and the speed of the engine is controlled in the normal manner by the two throttle levers (one for each group of four cylinders) varying the period of opening of the suction valves of the fuel pumps.

Auxiliary Machinery

The auxiliary machinery calls for some comment as part of the system has not previously been adopted on any motor ship. There are two large three stage air compressors each coupled to a six cylinder Diesel engine of 400 brake horsepower which serves for the supply of blast injection air as well as that required for starting purposes. This is necessitated in view of the fact that the main engines do not drive their own compressors. When the vessel is at sea one of the Diesel driven compressor sets serves for both main propelling motors, although it will apparently be nearly loaded up to full power, thus indicating the amount of power taken by the blast air compressor on a Diesel engine.

The electrical generating plant comprises a couple of 300 horsepower six cylinder Diesel engines running at the extremely high speed of 375 revolutions per minute and driving 220-volt 215-kilowatt direct current generators. All the engine room pumps including two cylinder cooling, one piston cooling, two lubricating oil, ballast, fresh water, sanitary and bilge pumps are coupled to electric motors, but the boiler will have to be in service the whole time at sea owing to the galley requirements.

An electric refrigerating plant is provided and there is an emergency dynamo driven by a hot bulb engine to supply electric power in case of the engine room being flooded.

Navy Yards Cannot Bid for Reconditioning of Leviathan

PRESIDENT HARDING has announced in a letter to Representative Dallinger of Massachusetts that the work of reconditioning the *Leviathan* cannot be done at the Boston Navy Yard, as urged by Mr. Dallinger, but that the contract will be let, if Congress is willing to appropriate the necessary funds, to the private company that makes the lowest bid. The President gave as his reason that a navy yard cannot, under the laws, submit a definite bid for the work and also that it is the policy of the administration, as well as of the Jones merchant marine law, to encourage private shipbuilding enterprises. He also pointed out that insofar as the work would tend to relieve unemployment, the result would be the same wherever the work is done.

While no direct appropriation for the *Leviathan* has been asked by the Shipping Board, the question as to whether the money should be spent has been put up to Congress in the statements made before the appropriations committee by officials of the board, who have shown how much money is needed for various purposes and just what use it is proposed to make of it. An estimate of the amount necessary to recondition the ship has been included in the calculations as to the use proposed to be made of the appropriation of $55,000,000 from the proceeds, if the liquidation of assets is continued.

Conference of Maritime Nations Proposed

HOMER FERGUSON, president of the Newport News Shipbuilding and Dry Dock Company, in a conference with the President on January 9, attended also by Chairman Lasker of the Shipping Board and Senator Jones, urged that a plan be submitted to the arms limitation conference for calling a conference of the leading maritime powers to discuss merchant marine questions, including a proposal for a pooling of ocean commerce so that the ships of each nation could be assured of 50 percent of the direct traffic to and from its ports. The President was not in agreement with this suggestion, on the ground that the agenda of the arms conference should not be added to, but expressed the opinion that there are many questions which might profitably be discussed at such a conference at some other time.

Diesel Electric Propulsion of Ships

Advantages of Diesel Electric Drive—Types of Vessels for Which It Is Applicable—Comparison With Steam

By Commander S. M. Robinson, U. S. N.

At the present time the greatest interest is being manifested by all marine engineers in the development of the Diesel engine for marine purposes. This is doubtless partly due to the fact that the World War practically stopped all development of the marine Diesel engine except in the case of the submarine as there was no time for experimental work. But this check seems to have given added impetus to the development work going on at the present time. This is particularly true of the European shipbuilders. The British have tackled this problem with characteristic thoroughness as is evidenced by the great number of types of marine Diesel engines that they have under construction and in operation.

The saving in fuel that is effected by the Diesel engine over all other forms of propulsion is so great that it appears to be only a question of a short time before it will entirely replace steam in certain classes of ships and eventually it will probably be found in all classes of ships. The increasing cost of fuel makes this saving of greater importance as time goes on. This fact is apparently recognized in Europe where a large percentage of ships building are being equipped with Diesel engines.

It would seem that the development of the Diesel engine could be carried on much more rapidly, if every one appreciated the possibilities of electric drive in connection with it.

Advantages of Diesel Electric Drive

For one thing, it makes possible the use of large powers at once; it is not necessary to wait till the Diesel has been developed in large units as a number of small units can be used to give the desired power.

Also, the Diesel is inherently poor in maneuvering qualities; for example, its speed cannot reliably be reduced below about one-third speed and it has to be started and reversed by air. The use of air is not only entirely unsatisfactory but is distinctly bad for the engine; also air control requires complicated valve mechanism (and therefore complicated cylinder heads) and air storage bottles. These disadvantages are entirely done away with by the use of Diesel electric propulsion.

The present practice in regard to the speed of the Diesel engine gives a propeller that is not the most efficient and the tendency is toward still higher speeds. One need only compare the high speed engines of a submarine with those of a merchant ship to see what the possibilities are in regard to saving weight by increasing the speed. With electric propulsion, the higher the speed of the engine the more suitable it will be as a prime mover and the motor speed can be arranged to give the most efficient screw.

There is no question but what very little time and money have been spent on the development of a reliable high speed engine as compared with what has been spent on the slow speed engine. When more attention is paid to obtaining perfect balance, it is probable that the high speed engine will develop very rapidly as it will make it possible to get large powers with small cylinders, thus avoiding many of the difficulties of design.

The reliability of the Diesel engine is much improved by the use of electricity in connection with it; this is due partly to the fact that air starting and reversing are eliminated and partly to the use of multiple units; this latter advantage will be discussed more in detail when considering individual cases.

These are the general advantages of Diesel electric propulsion but a proper discussion of this subject can be had only by considering each type of ship separately and in each case the conditions must be chosen to represent actual conditions as nearly as possible. Several papers have recently been presented on this subject and they have not followed this rule; for example, if we have a 2,000 shaft horsepower ship driven by twin Diesel engines running at 150 revolutions per minute, obviously it is no comparison at all if we choose twin screws running at the same speed for the electrically propelled vessel. To get a real comparison, we should use a single screw running at about 90 revolutions per minute, otherwise we deliberately throw away a very considerable part of the advantage of the electric propulsion for this case.

Why Direct Current Is Used

The first question to be decided in connection with Diesel electric propulsion is whether direct current or alternating current will be employed. Where it is desired to have two or more units operating together to drive the motor (or motors) on one propeller shaft, it will be advisable to use direct current. This is due to the fact that Diesel engines do not operate well in parallel as the governor regulation is not sufficiently good. It is true that Diesel driven generators are successfully operated in parallel on shore but it would be out of the question on board ship or any place where it is necessary to change the speed of the engines while keeping them in parallel as would be the case if alternating current were used. By using direct current, the generators and motors can be operated in series so that close regulation of the engine speed will not be required. Direct current also obviates the necessity for changing the engine speed since speed variations can be taken care of by varying the generator or motor voltage.

When using direct current, series operation will usually be desirable not only because it is more suitable for the engines but also because it is better electrically. Voltage variation would be used for propeller speed control and, with parallel operation, this would require generators with practically identical saturation curves and very carefully adjusted field rheostats, while with series operation no such requirements would exist. But more important still, the failure of one unit reduces the power more with the parallel than with the series operation since in the former case it would be necessary to reduce the generator voltage to accomplish the necessary reduction in propeller speed and this would lower the output of the generators. With series operation, the generators would work under practically full load conditions regardless of the number in use.

When Alternating Current Would Be Advisable

In the case of ships fitted with two or more propellers, each having its motors driven by its own generator, it will usually be preferable to use alternating current owing to the greater efficiency of transmission. In the case of large powers, there would also be greater reliability and a reduction in weight and space. Here the difficulties previously mentioned would not exist since the generators would not be operated in parallel and the speed of each engine would be independently controlled. In case of failure of one generating unit, the other would be used to drive all motors, the latter being operated in parallel, which would be satisfactory.

The first type of vessel to be considered will be the low powered merchant vessel since Diesel electric propulsion offers more advantages for this type of vessel than for any other at the present time.

Application to Low Powered Merchant Vessel

The power involved is small so that the generators used for propulsion will also be suitable for furnishing power to run the deck winches when in port. This represents a large saving in weight and space and gives economical service.

There will be no loss of propulsive efficiency due to the use of the electric transmission with these ships. This is due to the fact that a single, large, low speed propeller will be used with the electric propulsion and two propellers of higher speed with the direct propulsion. The appendage resistance with the two-propeller arrangement added to the increased thrust deduction just about makes up for the electric losses. The single, low speed propeller is more efficient than the high speed propellers so that the overall efficiency should be somewhat greater with the electric propulsion than with the direct propulsion.

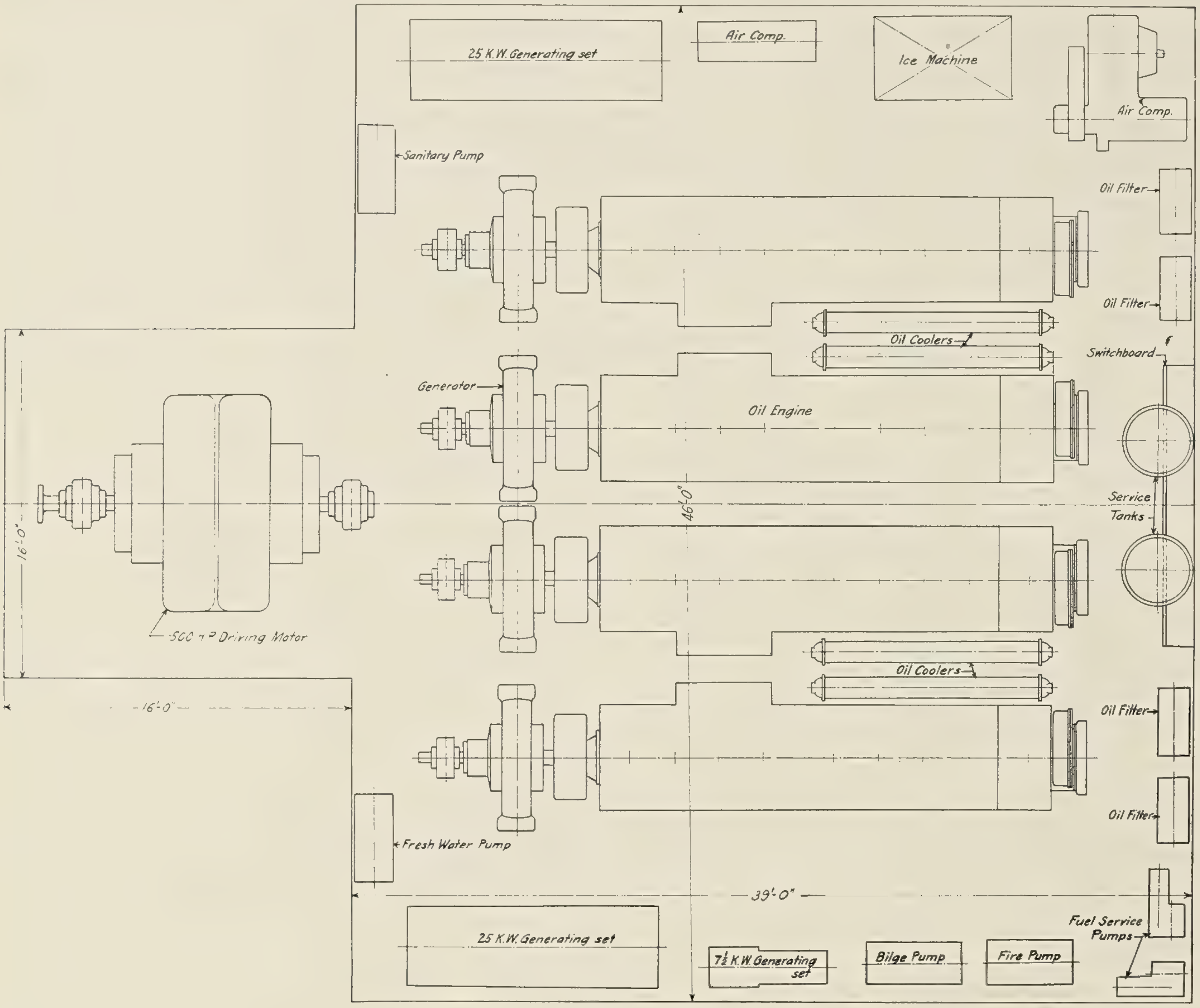


Fig. 1

Arrangement of Machinery

An ideal arrangement for this type of ship consists of three generators driving two motors on one propeller shaft. The generators and motors would be separately excited. The excitation would be furnished either from small generators direct connected to the main units or from separate generators which could be used for furnishing power to the ship's circuits. When using the main units, the direct-connected exciters not used for excitation would be used for the ship's circuits, thus making it possible to shut down all generators except the main units.

All units would be started electrically, using the generator as a motor. Power for this purpose would be furnished by small independent generators; these, in turn, would be started by a small generator which could be started by hand so that it would never be necessary to use air for starting.

The generators and motors would all be connected in series; reversal would be accomplished by reversing the generator field. With this type of ship, it would not be necessary to provide armature resistance to get the necessary torque for reversal; the friction load of the Diesel engine, shafting, etc., is sufficient for this purpose in this case. With high speed, high powered ships this would probably not be true.

Speed Control

Speed control would be accomplished by varying the field of the generators or the motors or changing the speed of the engines, according to circumstances. Normally, speed changes

would be effected simply by varying the generator field strength and this method would always be used for maneuvering.

To show how the different methods of speed control can be used and also how the ship would be operated at reduced power, the case already assumed—that of three generators and two motors—will be analyzed in detail.

If it were desired to operate at full speed all units would be in use. Reduction of speed would be accomplished by decreasing the generator field strength. If it were intended to make a trip at slightly less than full speed, it would probably be best to operate the engines at a slightly reduced speed. This speed once set, however, would not be changed.

If one main unit were out of commission, the other two generators and the motors would be run in series. The generators would be run at normal speed and would carry the same current and voltage as before and would therefore have the same efficiency as before. There would be available two-thirds (67 percent) of the full power and since the power varies approximately as the cube of the revolutions, the propeller would run at 87 percent of its full speed and the ship would be propelled at 87 percent of its full speed. Since the torque varies as the square of the revolutions, the torque required would be 77 percent of the full load torque and therefore the field strength of the motors would be 77 percent of full field; each motor would be developing 67 percent of its normal full power and would fall off slightly in efficiency. To sum up this condition, the generators would be operating at 100 percent speed, 100 percent voltage, 100 percent current and normal efficiency; the motors would be operating at 67 percent power, 87 percent speed, 77 percent field strength, 100 percent current and slightly reduced efficiency; the ship would be propelled at 87 percent speed. Speed reduction would be accomplished by decreasing the field strength of the motor.

If two main units were out of commission, the remaining unit and one motor would be used. The generator would be run at normal speed, current and voltage and therefore the efficiency would be the same as at full power. The propeller would run at 70 percent speed. The torque on the propeller shaft would be 50 percent of that at full power but since only one motor would be used that motor would develop 100 percent of its full load torque and would therefore carry 100 percent normal field strength since it would be carrying normal full load current. There would be a slight decrease in motor efficiency. To sum up this condition, the generator would be operating at 100 percent speed, 100 percent voltage, 100 percent current and normal efficiency; the motor would be operating at 67 percent power, 70 percent speed, 100 percent field strength, 100 percent current and slightly reduced efficiency; the ship would be propelled at 70 percent speed. Speed reduction would be accomplished by decreasing the generator field strength.

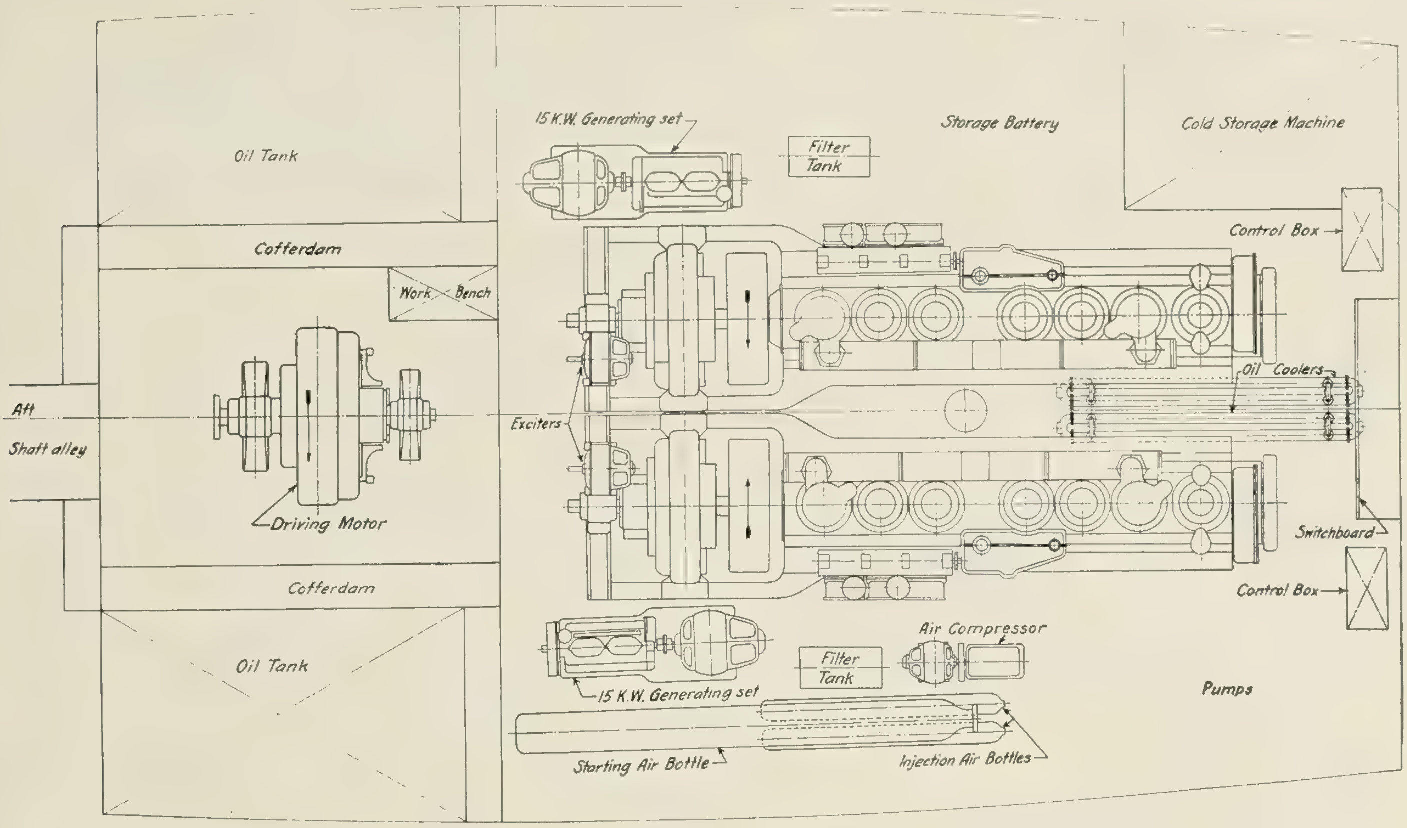


Fig. 2

Proposed Merchant Ship Installation

An arrangement for Diesel electric propulsion as proposed by the Winton Company is shown in Fig. 1. This arrangement consists of four main units and two main motors arranged as a double armature motor to save space and weight. There are two 25-kilowatt generating sets for general ship's service and a 7½-kilowatt generator arranged for hand starting. All auxiliaries are motor driven. The main units are provided with direct-connected exciters which can be used either for excitation or ship's service. The voltage of the main generators is such that they can be used for running cargo winches.

Diesel electric propulsion offers a means of modernizing ships which are equipped with steam plants. For example, many of the Emergency Fleet Corporation ships which are equipped with turbines and reduction gears could readily be converted into Diesel electrically propelled ships without any change in propellers, shafting or bulkheads. This would make these ships operate at about one-third of the present fuel consumption.

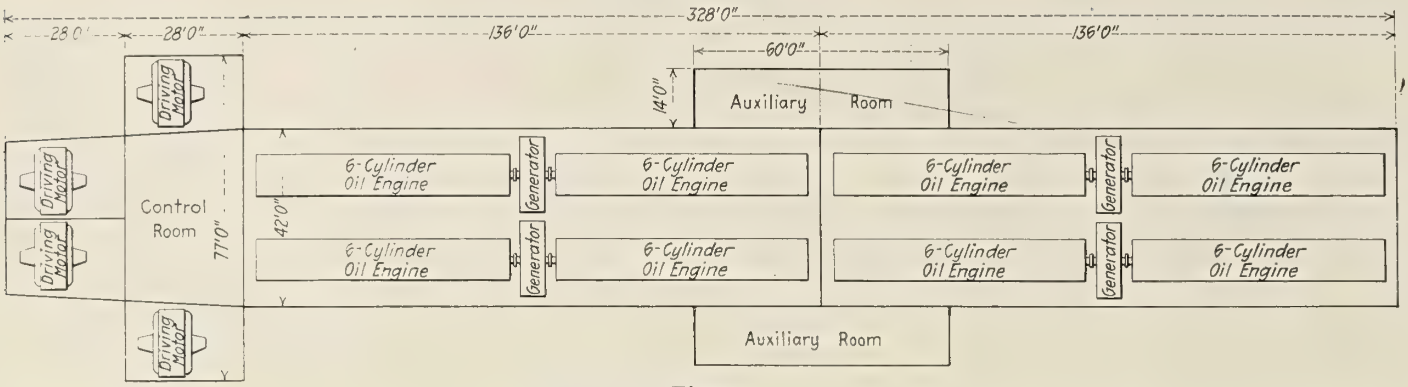


Fig. 3

Yachts and Pleasure Craft

The next class of vessel to be considered will be yachts and other pleasure craft. The special advantages of Diesel electric propulsion here are that it provides a long cruising radius at reduced power and at the same time gives high speed for short runs; also the machinery can be located so as to give the best accommodations for the passengers. The advantage in regard to increased cruising radius is quite marked. Assume that cruising would be done at about half power; the direct connected Diesel would be run at about 79 percent speed and 50 percent power, if both engines were used or else at not more than about 70 percent speed and 70 percent power (assuming that the normal mean effective pressure should not be exceeded), if one engine were disconnected and the screw allowed to revolve freely while the other engine was used for driving the ship. The latter arrangement would necessitate the use of clutches for disconnecting the engines. In the first case the engine efficiency would not be nearly so high as at full power; in the second case, the horsepower required would be very materially increased by the dragging screw; in neither case would the propeller efficiency be as high as for the single screw electric arrangement. With the latter, the ship would cruise at 79 percent speed with one main engine running at full speed and full power (assuming two units to be installed).

An arrangement of machinery for Diesel electric propulsion for this type of vessel is shown in Fig. 2, which is a plan of the engine room of the schooner yacht *Guinevere.* The machinery consists of two 350-horsepower Winton engines operating at 225 revolutions per minute and driving two 225-kilowatt Westinghouse generators, and a 550 horsepower Westinghouse motor driving a propeller at 220 revolutions per minute. A 15-kilowatt exciter is connected to each main unit by a chain drive. All of the generators give 125 volts. All auxiliaries, including the steering engine, are electrically driven.

Double Ended Ferryboat

Another type of vessel for which Diesel electric propulsion offers special advantages is the double ended ferryboat. As usually arranged, these boats have two propellers, one at each end of the ship; both are placed on the same shaft and are driven by an engine located near the center of the ship.

This is an extremely inefficient arrangement since both screws are driven at the same speed. The result is that the screw current of the forward screw is discharged against the bow of the boat and adds enormously to the horsepower required to drive the boat through the water. This may amount to 40 percent or more of the effective horsepower required to propel the ship.

The proper method of operating these propellers is to drive the forward propeller at a speed just slightly above that at which it would run if it were allowed to revolve freely while the ship is being driven by the other propeller—in other words, just fast enough to prevent it from acting as a drag on the ship. This speed is approximately 70 percent of the revolutions corresponding to the speed of the ship. This method of operation requires that the two propellers be on separate shafts. With electric motors, it is a very simple matter to adjust the speeds of the two motors quite accurately and quickly since it would be a matter only of watching the ammeters of the two motors. The same result might be approximated in an engine-driven boat by using a separate engine to drive each propeller but there would be no means of adjusting the speeds accurately and, in any case, the method would not be efficient since one engine would always be running with practically no load.

Flexibility of Installation

Another advantage of this method of propulsion for this type of vessel is the flexibility in regard to installation. This is well illustrated by the ferryboat *Poughkeepsie* being built for the Highland Ferry Company. This vessel has a very wide flat hull with a "hull-fin" extending below the main hull. The hull-fin carries the propelling motors and in this case is nothing but a deep shaft tunnel. It would hardly be possible to place engines in such a narrow compartment but it enables the propellers to work in solid water as they are entirely housed by the hull and also to work in water which is unbroken since there are practically no obstructions ahead of the propellers.

The stability of the vessel is obtained by the use of the broad flat hull which makes it practically impossible to capsize her by loading. Unfortunately, the *Poughkeepsie* is arranged with both motors and both propellers on one shaft so that the great advantage of increased propulsive efficiency will not be realized.

Reliability in Maneuvering

For ferryboats perhaps the most important advantage of the Diesel electric over the direct Diesel drive is the greatly increased reliability in maneuvering. It is perhaps no exaggeration of the facts to say that, at the present stage of development, electricity makes possible the use of the Diesel engine with this type of vessel.

Other more minor advantages of Diesel electric as compared with steam installations are the absence of stand-by losses when the vessel is not running and the absence of a smoke pipe which makes it possible to have a perfectly clear main deck, thus much improving the freight and passenger carrying space.

The limitations as to size have in the past prevented the consideration of the Diesel engine for high powered ships such as capital ships of the Navy and passenger vessels but the present rapid development of this engine indicates that these limitations will shortly be removed. Even at the present time, several of the best engine builders are prepared to furnish units of 6,000 brake horsepower in six cylinders. It is interesting to see what could be done with an installation in a capital ship using this unit as a basis.

DIESEL ELECTRIC DRIVE FOR A CAPITAL SHIP

Fig. 3 shows an outline of such an installation. It consists of eight 6,000 horsepower engines driving four generators which furnish current to four induction motors driving four propellers. The 12,000 horsepower generator is placed between the two engines so that it is unnecessary to transmit power through more than six cranks. The installation will also be lighter and occupy less space than it would if a separate generator were used for each engine. There is, however, a more important reason for not using more than four generators.

For transmitting this amount of power it will be preferable to use alternating current at much higher voltage than would be possible with direct current. This is desirable from the standpoint of efficiency, weight, space and reliability. The objections to the use of alternating current disappear with this type of installation since each generator would drive its own motor and the generators would at no time be connected together. When cruising at reduced speeds either one or two generators would be used. In the first case the motors would all be in parallel; in the second case, each generator would drive two motors connected in parallel, on one side of the ship.

COMPARISON OF WEIGHTS

It is interesting to compare the weight of such an installation with a steam drive. It is estimated that the main units of the installation described above would weigh about 3,120 tons; this includes the weight of the Diesel generators, main motors, switchboards and cable. The total installation in the ship would weigh about 4,130 tons. A corresponding steam installation would weigh about 3,560 tons or 570 tons less than the Diesel electric. If we assume a fuel supply of 3,000 tons for the steam installation, this would leave 2,430 tons for the Diesel electric in order that the two should have equal weight at the beginning of a cruise. The Diesel electric installation would use not more than half the fuel that the steam drive would require so that the cruising radius would be increased $\frac{2430}{1500}$ or 1.625 by the use of Diesel electric propulsion.

There is no question but what the future development of the Diesel will give us a lighter engine for the large powers so that the comparison in regard to fuel will be even greater in favor of the Diesel. The double acting Diesel is still in its infancy and the same can almost be said of the crosshead engine; but that the development of the Diesel from now on will be rapid no one can doubt and it would appear that, eventually, there should be no limitation as to its uses for marine purposes.

Diesel Electric Cargo Vessel Fordonian Given Trial

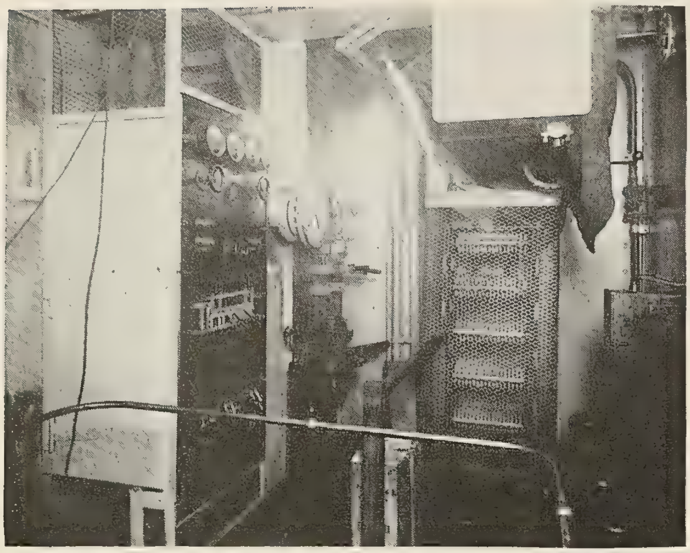
First American Sea-Going Motorship to Be Fitted With Diesel Electric Method of Propulsion

THE *Fordonian,* the first ocean going merchant ship in the United States to be equipped with the Diesel-electric method of propulsion, was given her official sea trial on January 13. A party of over fifty prominent marine engineers and shipping men attended the trial, which shows an unusual amount of interest in the claims set forth for the adoption, from the economical standpoint, of the Diesel electric drive for cargo ships.

The *Fordonian,* which was formerly fitted with direct Diesel drive, was re-engined by the Tebo Yacht Basin of the Todd Shipyards Corporation. She is 250 feet long with a 42-foot beam and has a gross tonnage of 2,368 tons. The vessel is owned by the American-Mediterranean Steamship Company, McDonnell and Truda, agents, and will be engaged in the freight traffic between New York and Havana. The *Mariner,* a 200-ton fishing trawler, is the only other commercial ship with a similar machinery installation in this country today.

The *Fordonian* represents the culmination of several years of development work in successfully adapting electric trans-

Motorship Fordonian, Equipped with Diesel Electric Drive, on Her Trial Trip



View of Switchboard, Rheostat and Operating Station

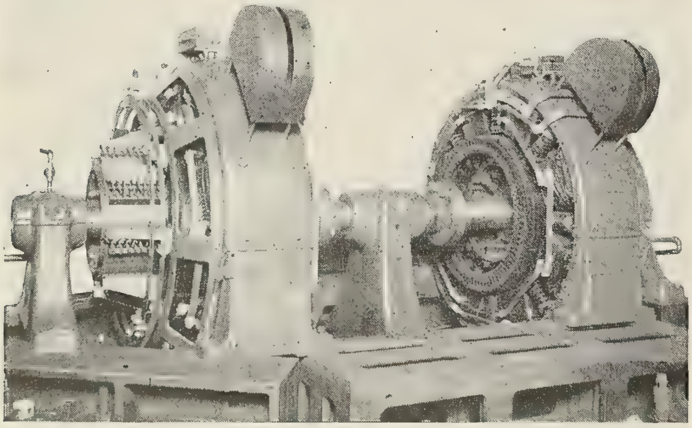
Propelling Motor and One of the Main Engines

mission to the oil engine for large ships. The electric apparatus is of the General Electric Company type consisting of two 350 kilowatt generators each driven by a two cycle four cylinder Ansaldo San Giorgio Diesel engine of 500 brake horsepower. Motive power is supplied by a double armature 850 horsepower motor direct connected to the propeller and designed to furnish a speed of about nine to ten knots.

The control is from the engine room and has been devised to give the utmost flexibility of operation. The main control equipment consists of a panel on which are mounted the various switches, field rheostats and instruments; a master controller for operating the contactors of the control group; the control group for starting and reversing the motor, and a starting resistor and motor field resistor for obtaining lower speed ranges. The normal operating propeller speed is 120 revolutions per minute. The control arrangement allows for the use of either or both generators supplying current to the propeller motor, depending upon the speed requirements.

Captain C. J. Dyer of the *Fordonian* declared after the trials that the performance of the ship had exceeded his best expectations and that the ease with which she was maneuvered and controlled in the congested shipping of New York Bay "gives promise of a bright future for ships using Diesel engines in combination with electric drive. I wouldn't change her for a steam driven ship under any condition." W. N. Hooks, chief engineer, was equally pleased with the performance of the ship.

The *Fordonian* developed a speed of 10.12 knots on the trial, which greatly exceeded the expectation of the captain. In order to develop full propeller speed of 120 revolutions per minute the motor developed 720 horsepower at the propeller shaft. With the ship fully loaded the motor will be called upon to deliver the full rated horsepower of 850 in order to turn the propeller at this speed.



Two 350-Kilowatt Direct Current Generators for the Fordonian

Prominent Shipping Men Attend Trial

Among the engineers present at the *Fordonian's* trials were the following: P. Bryan, General Electric Company; J. J. Brown, Westinghouse Electric Company; A. F. E. Horn, General Electric Company, Washington, D. C.; G. Smith, United States Engineers Office, War Department, Washington, D. C.; T. R. Vogel, United States Engineers Office, War Department, Washington, D. C.; Lieut. Col. H. Allen, United States Engineers Office, War Department, Washington, D. C.; Commander S. M. Robinson, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.; Commander Jones, U. S. N., Washington, D. C.; Commander Walton, United States Coast Guard; W. P. Marshouse, Pennsylvania Railroad Company; E. Keane, United States Government; P. J. O'Reilly, United States Boiler Inspector; H. Ehrlich, Custom Inspector; H. Westlake, Custom Inspector; W. Richardson, Custom Inspector; R. O. Dunham, T. S. Gandy and B. S. Beach, General Electric Company, Schenectady, N. Y.; L. R. Ford, Worthington Pump and Machinery Corporation, New York; L. V. Armstrong, Ingersoll-Rand Company; H. Schreck, Consulting Engineer, New York; S. Wright, Busch-Sulzer Bros.-Diesel Engine Company, New York; F. J. Moran, General Electric Company, Philadelphia, Pa.; M. J. Hekking, Texas Oil Company, New York; Theodore D. Wells, Naval Architect, New York; T. O. Lisle, Editor *The Motorship;* C. H. Kennerly, Old Dominion Transportation Company; H. Lund, Chief Engineer; A. St. James, Texas Oil Company, New York; N. R. Sibley, Westinghouse Electric Company, New York; George L. Kay, Surveyor, American Bureau of Shipping; George Pogue, Busch-Sulzer Bros.-Diesel Engine Company; F. B. Webster, Editor Marine Engineering and Shipping Age; W. M. Johnston, John Bliss and Company; J. B. Bassett, General Electric Company; M. S. Katzenstein, Worthington Pump and Machinery Corporation; L. G. Nunes, and G. Campiglie, Ansaldo Engine Company; J. W. Anderson and G. E. Edgar, New London Ship and Engine Company; P. Levinthol, Naval Architect, New York; A. Kennedy, W. H. Wild and J. Thomas, General Electric Company, N. Y.; P. McDonald, McDonald and Truda; Paul Henning and H. B. Taylor, United States Shipping Board.

Motor Tanker Zoppot, Fully Laden

The Motor Tank Ship Zoppot*

The successful operation of the Zoppot over a period of eighteen months has brought the Diesel engine into prominence as satisfactorily meeting the service requirements for propelling machinery in large tankers. Heretofore the reciprocating steam engine has found the greater favor for this type of vessel on account of the quick turn around in port and the ability of the steam engine to stand up under continued service. The performance records of the Zoppot prove the ability of the Diesel engine to meet demands for reliability and undoubtedly will lead to keener interest in this more economical type of machinery when solving the powering problems of future tankers.

THE motor tank ship *Zoppot*, which has been in service for over a year, covering 44,000 sea miles in the first ten months, has attracted considerable attention as a tanker, as well as a motorship, owing to its great size and carrying capacity. The *Zoppot* was built in the shipyard of Fried. Krupp Aktien-Gesellschaft of Kiel-Gaarden, Germany, for the Baltic American Petroleum Import Company of Danzig. It was recently taken over by the Standard Oil Company of New Jersey, however, and is now operating in the service of that company between New York, Baltimore and Mexico. Its style of construction and the installation of its main and auxiliary engines offer many notable improvements.

The vessel was constructed in conformity with the highest class of British Lloyd's with the designation ✠ 100 A-1 under special supervision and in accordance with the longitudinal system of framing. The *Zoppot* is the first large motor tank vessel built according to this system and the expectations of the builders have been entirely realized, for not only has more than 8 percent of the steel weight been saved as compared with transverse frame construction, which saving has added to the profits through increased cargo carrying capacity, but the longitudinal and transverse strength have in every instance been excellent. This was confirmed by experience on the first trips when, despite continuously heavy seas, no weak spots appeared in the strengthening of the hull. It must, however, be noted that the builders exceeded the requirements of the British Lloyd's and increased the scantlings of the reinforcement wherever they appeared insufficient, experiences gained with smaller vessels built according to the longitudinal framing system indicating the correctness of this precaution.

The principal dimensions and main particulars of the *Zoppot* are given in the following table:

Length overall	546 feet 11 9/16 inches
Length between perpendiculars	524 feet 11 inches
Breadth, molded	66 feet 2½ inches
Depth, molded to upper deck	41 feet 2 7/16 inches
Draft with summer freeboard	27 feet 7¼ inches
Deadweight at this draft	15,500 tons
Gross tonnage	9,932
Net tonnage	5.915
Horsepower, shaft	3,600
Speed, knots	10.5

The ship is built as a shelter deck vessel and has three continuous decks. The hold, which extends from the keel to the main deck, is divided by transverse bulkheads and a centerline longitudinal bulkhead to provide 22 cargo oil tanks, 11 on each side of the vessel. Cofferdams are fitted at the forward and after ends of the cargo tanks. A cofferdam is also arranged between tanks 2 and 3 and this, with the pump room, located amidships, separates the cargo tanks from each other in such a manner that three different kinds of oil can be carried simultaneously. On the second deck, outboard of the expansion tanks, are the summer tanks, of which there are also 22.

The total capacity of the cargo holds for oil amounts to 693,246 cubic feet. In addition to the tanks for liquid cargo there is a cargo hold between the collision bulkhead and the forward cofferdam and the entire space between the main deck and the shelter deck is also available for cargo. The capacity of these spaces amounts to 229,446 cubic feet.

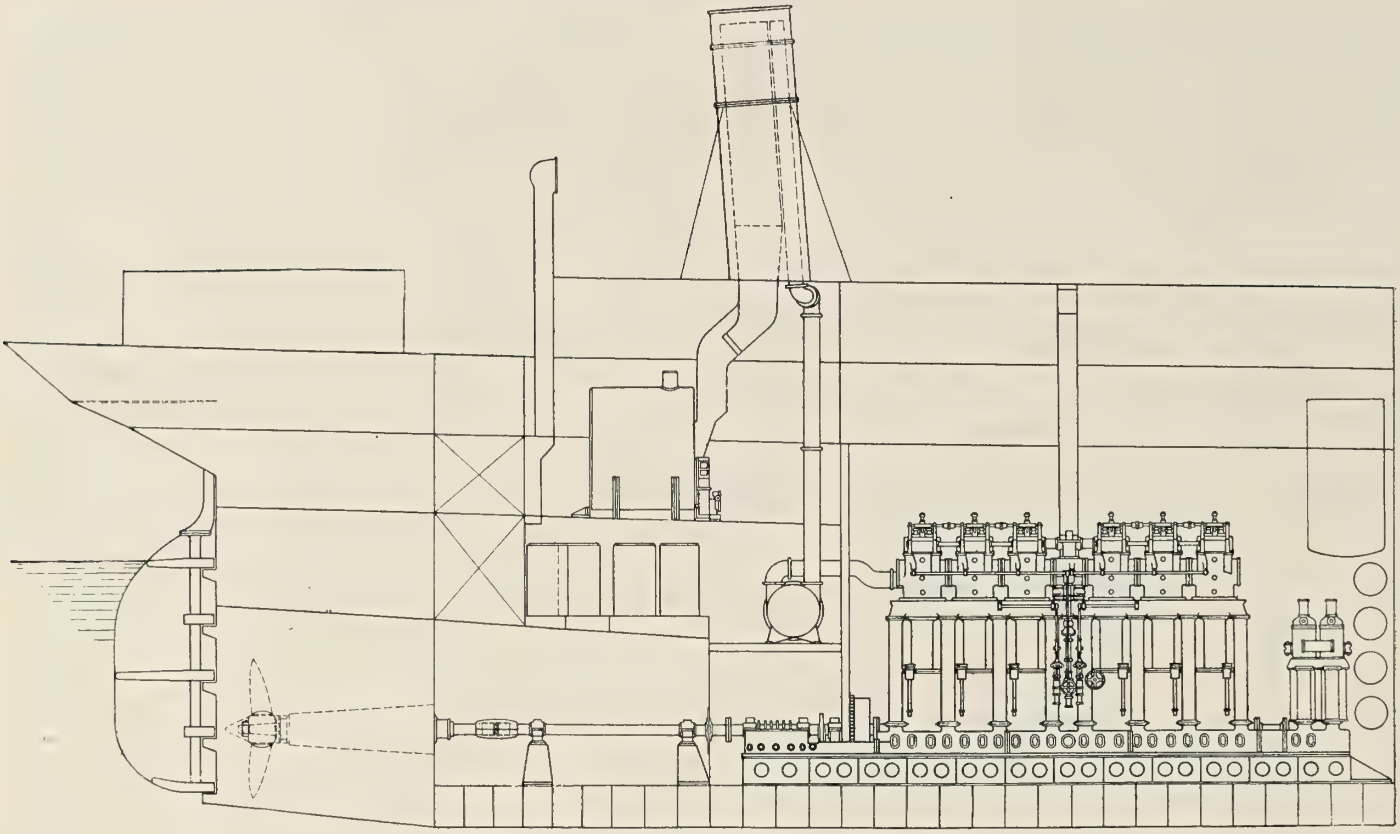
The engine room, as customary in large tank vessels, is located aft.

Hull

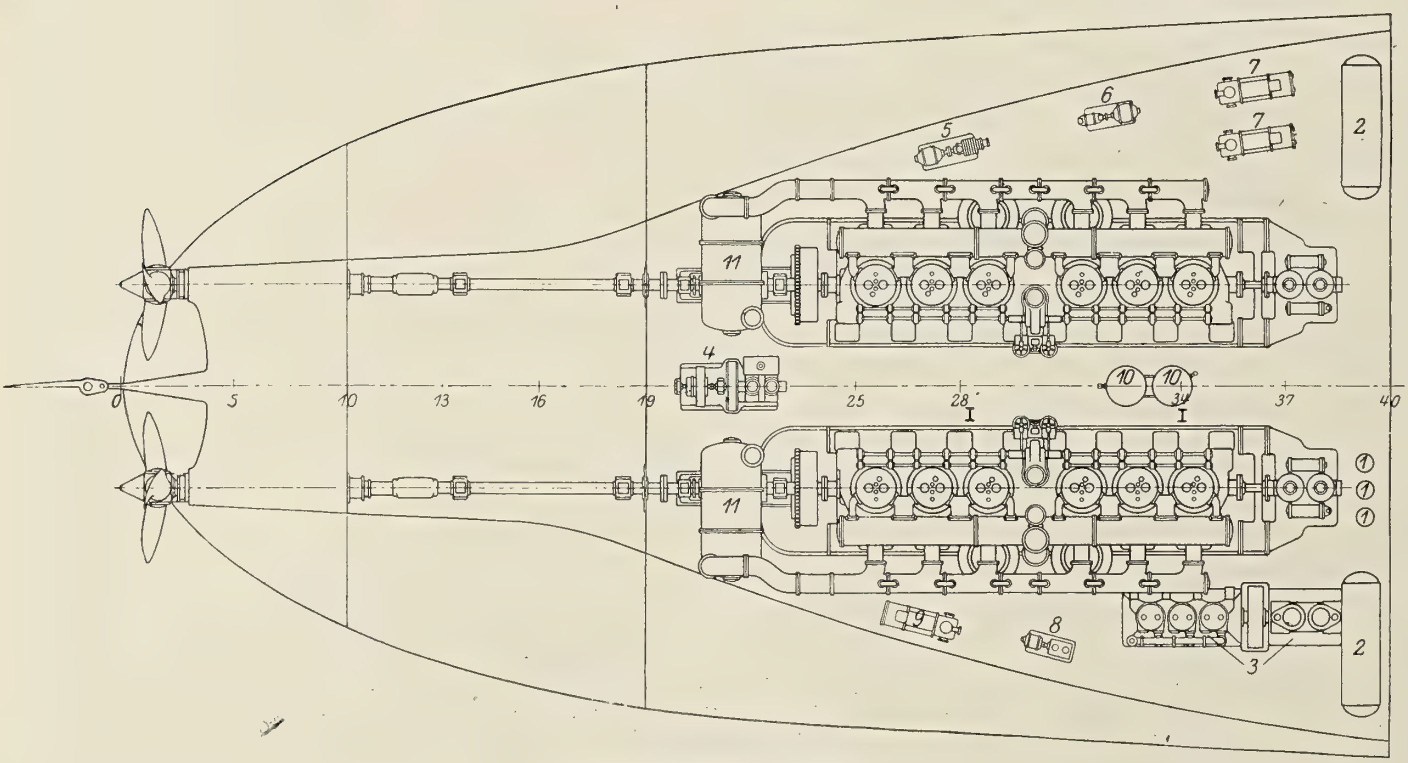
The construction of the hull is similar to the usual practice for longitudinally framed vessels.

There are 22 longitudinal frames on each side of the vessel below the main deck and 2 longitudinal frames between each of the decks above. Web frames are spaced 9 feet 2¼ inches apart and, as the cargo holds are uniformly 27 feet 6¾ inches long, there are 2 cross frames for each cargo hold. The oil tight longitudinal and transverse bulk-

*Translated from an article by Managing Director Oesten, Chief Engineer Alt., and Engineer K. Von Sanden of the Fried. Krupp Aktien-Gesellschaft, Germaniawerft, Kiel-Gaarden, Germany, which was published in *Werft und Reederei*, July 7, 1921.



Longitudinal Section Through Machinery Space



Plan of Machinery Space

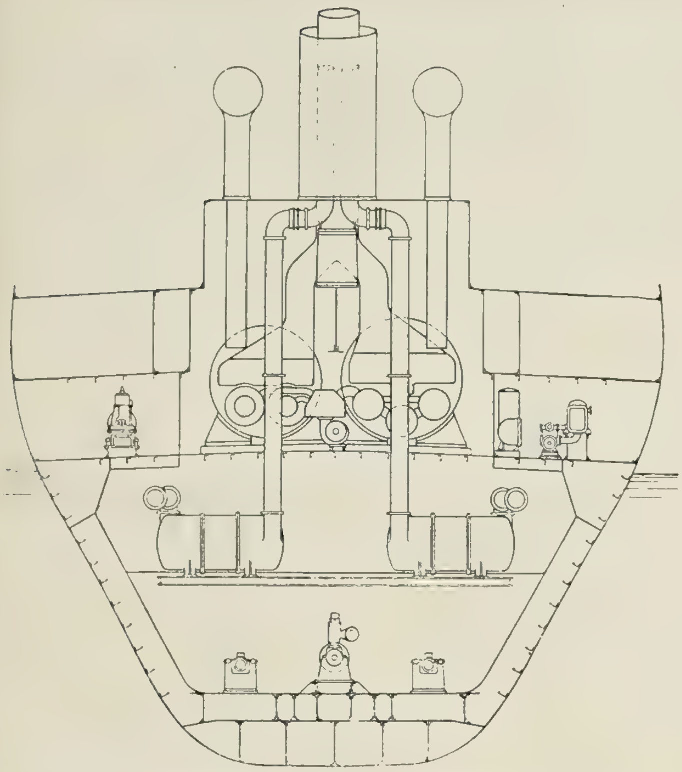
1—Air Supply Tanks
2—Starting Receivers
3—Diesel Auxiliary Compressors
4—Oil Engine Driven Dynamo
5—Electric Deck Washing Pump
6—Electric Ballast Pump
7—Duplex Ballast Pumps
8—Electric Oil Pump
9—Duplex Oil Transfer Pump
10—Special Fuel Tanks
11—Main Engine Exhaust Tanks

heads have horizontal plating and reinforcement and in the case of the transverse bulkheads 3 additional web frames are arranged on each side of the vessel. The longitudinal frames terminate at the transverse bulkheads and are connected by means of large brackets.

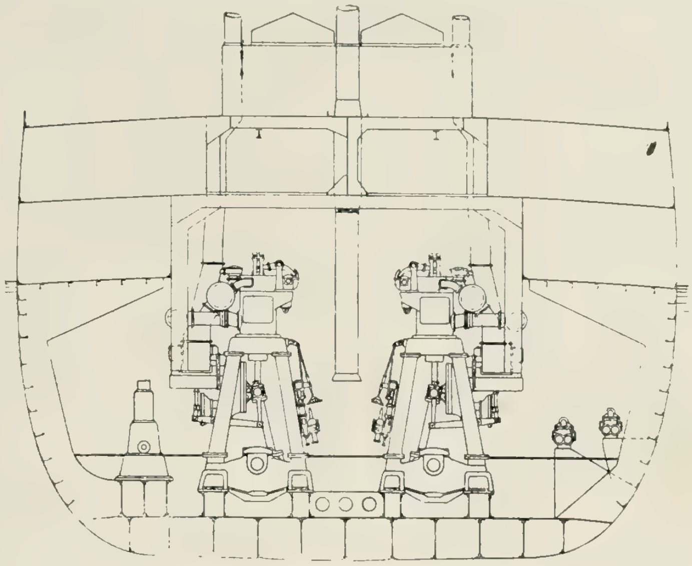
The stern post is notable because the propeller shaft struts are independent of the stern post proper, thereby effecting a saving in the weight of the steel casting.

The rudder is made up of a forged iron rudder stock and rudder-arms, the plate being 1.1 inches thick.

Cargo is discharged by two duplex, compound, steam pumps, 14.17 inches by 21.26 inches by 14.02 inches by 22.05 inches, each with a capacity of 500 tons per hour. These pumps are installed in the pump room. To empty the trimming tanks, the forward cargo hold and the cofferdam behind it, there is installed in the forward part of the vessel a duplex pump of 120 tons per hour capacity.



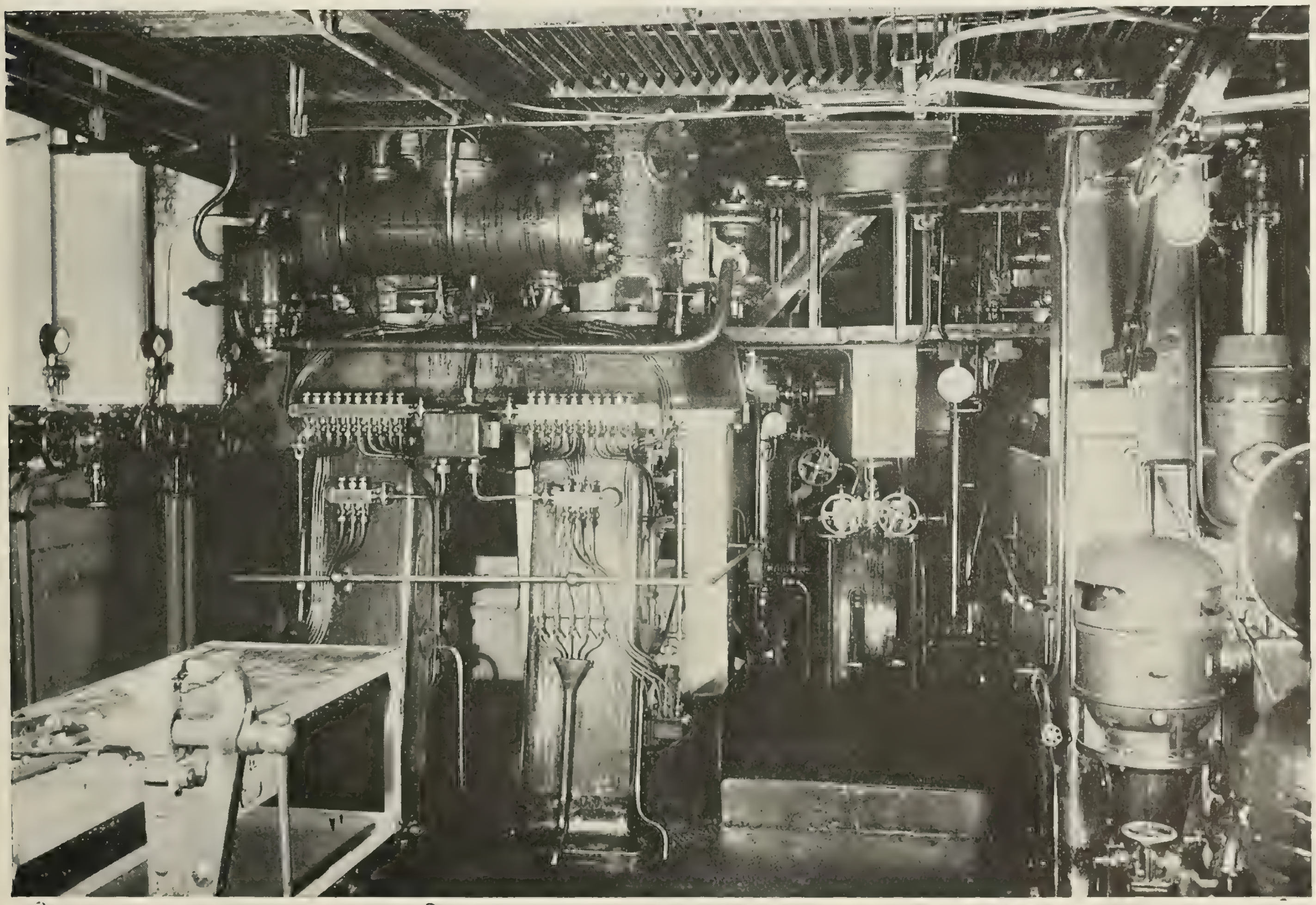
Transverse Section at Frame 24



Transverse Section at Frame 37

The loading and discharging devices, as also the fittings and mountings of the main and summer tanks, conform essentially to those of standard practice.

Two derricks are located forward and two aft at special posts. They serve the loading hatchway forward and the hatchways for stores and food supplies.



View in Engine Room, Showing Diesel Auxiliary Compressors

Quarters for the crew are provided below the bridge and in the after part of the vessel. All quarters are heated by steam as is also the main engine room.

The engine room personnel consists of 1 chief engineer, 2 second and 2 third engineers, 3 assistants, 1 storekeeper, 3 oilers and 3 stokers.

Main Propelling Machinery

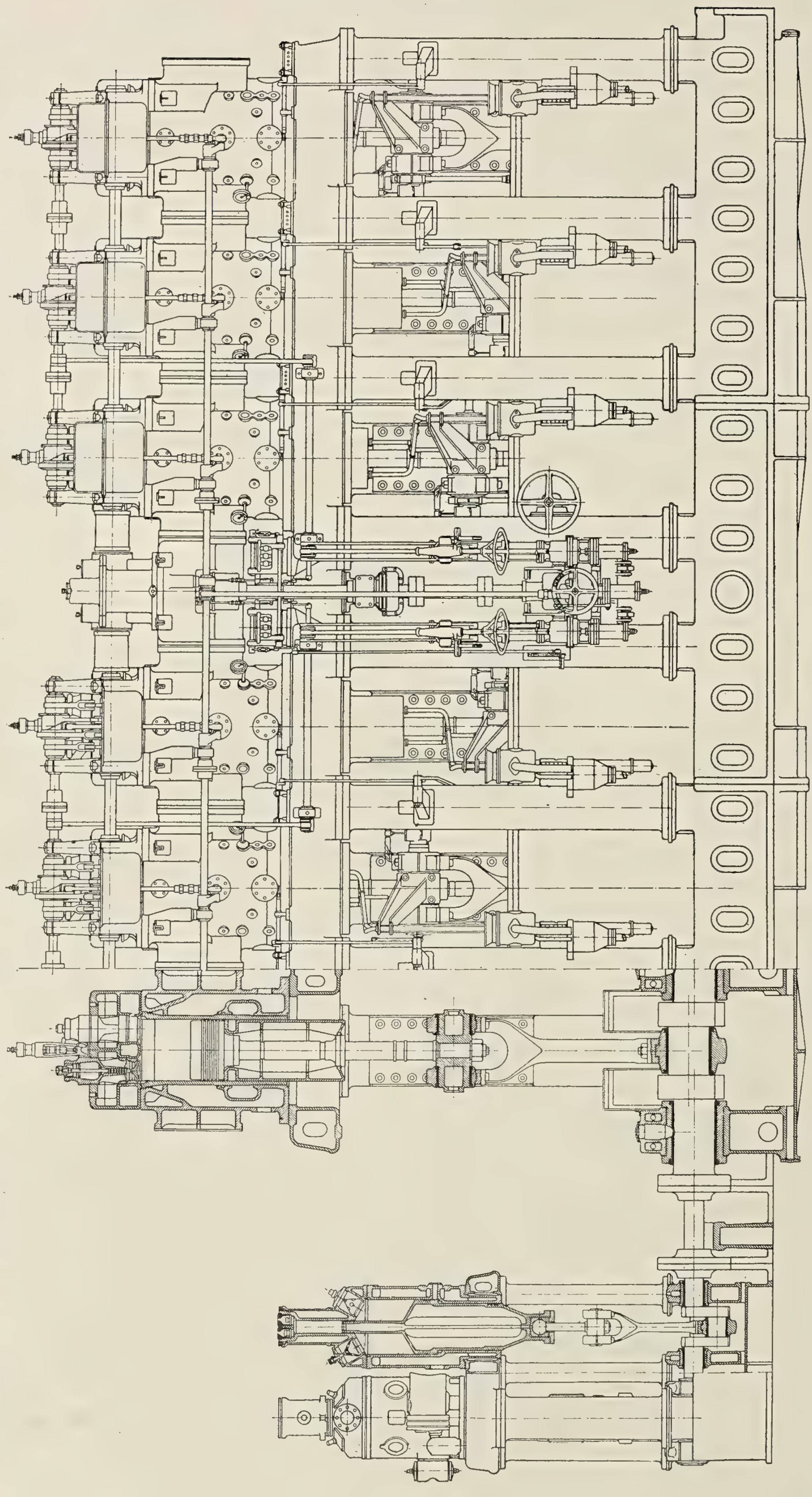
Owing to the easy loading and discharging (from 1 to 2 days) the stay in port for this type of vessel is particularly short and the number of traveling days greater during the year than with other freighters. For this reason, the oil engine plant must be absolutely efficient, the requirement for maximum reliability preceding all others.

The two Germania Diesel engines used to drive the vessel work on the two cycle principle. Their main particulars are as follows:

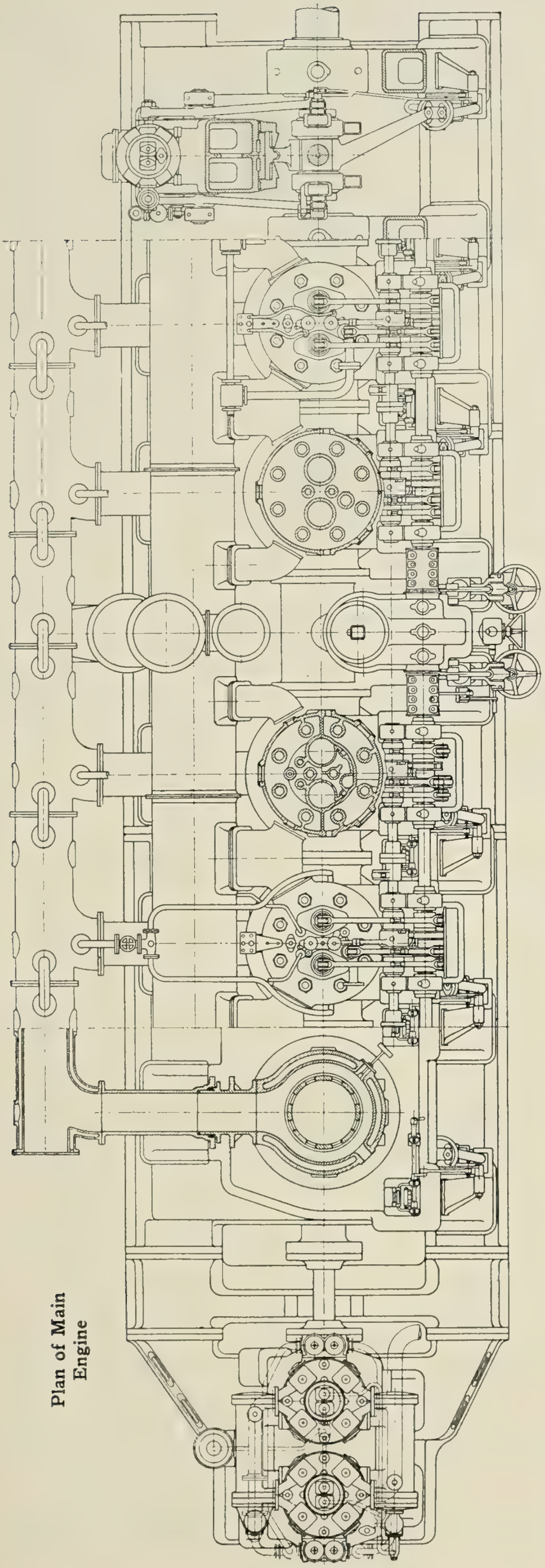
Number of working cylinders	6
Number of compressor cylinders	2
Number of scavenging pump cylinders	2
Diameter of the cylinder	22.638 inches
Normal operating R.P.M.	106
Piston stroke	39.37 inches
Indicated horsepower of both engines, fully loaded vessel, under above operating conditions	2,360
Effective horsepower figured on a mechanical efficiency of 0.71	1,675

The 6 working cylinders are located on a base plate above the columns and connected with each other by strong flanges. The base plate is divided to form 2 three-cylinder blocks between which there is an intermediate piece which takes the upper thrust of the cam shaft, thus assuring the maximum rigidity of the entire engine.

In the cylinders there are fitted special liners



Longitudinal Section and Longitudinal View of Main Engine



Plan of Main Engine

of the type successfully used in submarine boat engines.

In the cylinder cover there are arranged two scavenging and two fuel valves similar to those of the large submarine four cycle engines which proved very satisfactory in service. There are also provided one starting and safety valve with adequate cross section.

Cam and lever shafts are supported in common bearings placed on the rigid cylinder block. In this manner an exact control of the fuel needles is assured and the roller arrangement of the fuel valve lever, which actuates both valves, can be adjusted in operation, regulating the engine in the shortest possible time so that the indicator diagrams, even in long operation, remain unchanged. In this way the load of the individual cylinders can be made very uniform, which is of importance for trips covering weeks of uninterrupted sailing. Each scavenging valve has its own actuating lever.

The working piston consists of an upper part bearing the rings and a casing to cover the discharge ports. The cooling of the pistons is effected by sea water, which is fed and discharged by means of telescopic pipes.

The compressor (injection pump) is driven by the extended crank shaft. There are two similar cylinders with three-stage pistons with the medium pressure piston under the low pressure. The engine has the usual connecting rods with special crosshead guides. The air of the individual stages in both cylinders is cooled off in pipe nest coolers with suitable separators. The valves of the low and medium pressure stages are plate valves and those of the high pressure stages conical valves.

The two double acting scavenging pumps are driven by means of rocker arms from cylinders 3 and 4 and are provided with plate valves.

For driving the rudder engine, a two-stage rudder air compressor driven by a rocker arm from cylinder 6 is provided to supply compressed air at 8 atmospheres.

Two cooling water and bilge and one deck washing pump are driven by the savenging pump rockers and a fuel supply pump is driven by the rudder air compressor rocker.

Lubrication

Forced lubrication of the main bearings is effected by a geared pump driven by the crank shaft. The lubricating oil is supplied from a tank located in the double bottom. The worm wheels and the rocker bearings also receive forced lubrication. Special force pumps are arranged for the lubrication of the crosshead pins. The lower connecting rod bearings are provided with oil cup lubrication which is also provided as emergency lubrication for the main bearings and the crosshead pins.

For cylinder lubrication there are provided special lubricating pumps of simple and very solid construction.

All the oil flowing from the driving mechanism accumulates in the bedplate and flows to a drain tank located in the double bottom.

As reserve for the connected geared pumps there are provided two electrically driven geared pumps.

Maneuvering Compressor

Despite the very liberal capacity of the compressors, which are directly coupled to the main engines and which at full speed are able to develop a 200 percent addition to the quantity of air normally required for the rudder engine, an additional special Diesel auxiliary compressor is installed. This Diesel auxiliary compressor supplies, at 240 revolutions per minute, three-quarters of the maximum quantity of air delivered by a main compressor. It is used in long continued maneuvering with a low number of revolutions of the main engine and long stops. It also serves as reserve for the directly coupled compressors. The three-cylinder, single acting, four-cycle, driving engine corresponds to a medium

speed motor type, without piston cooling, which has proven very satisfactory and which has been frequently manufactured for shore plants.

Auxiliary Machinery

The auxiliaries on a motorship and particularly on a motor tank ship claim special interest. Steam operation of the auxiliary engines has been selected for the *Zoppot* for river navigation and port service, and in view of the justly strict regulations in ports where petroleum and benzine are handled, this solution offers the greatest safety.

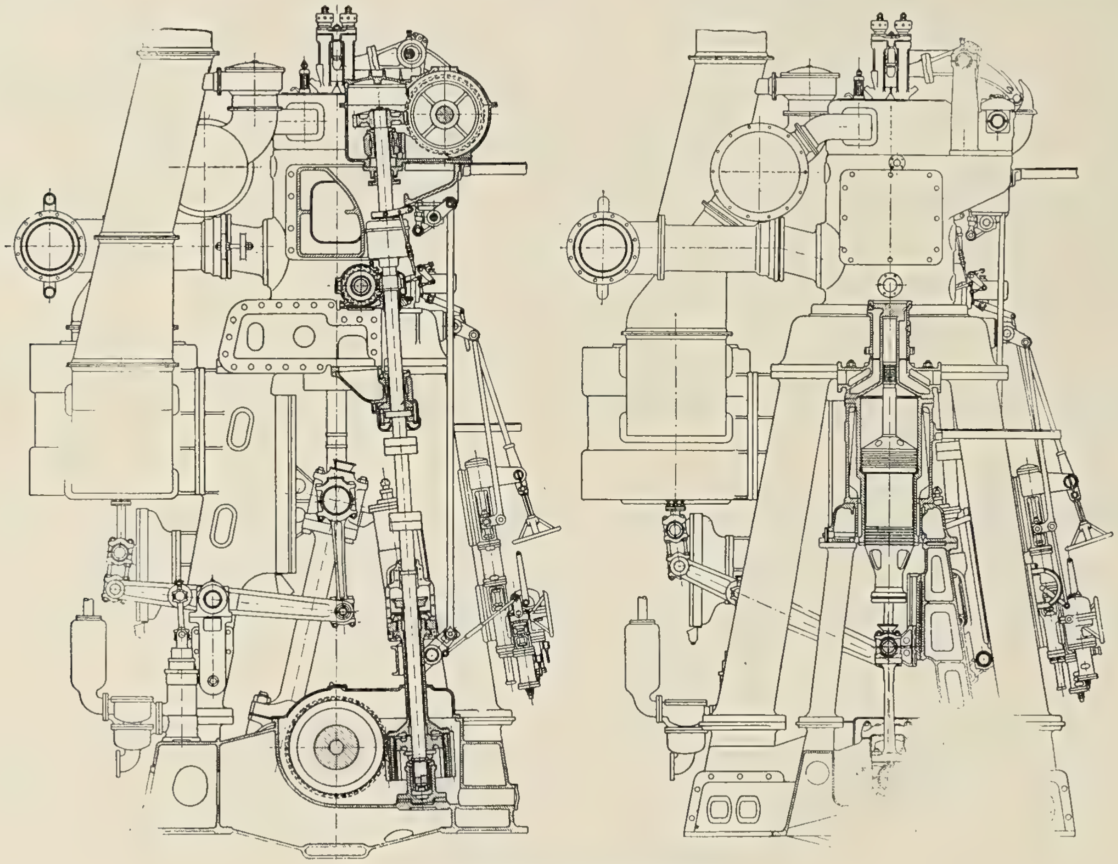
Steam is produced in two auxiliary boilers with oil fuel. The fuel oil is vaporized by pump pressure without the assistance of air or steam. The starboard boiler has two and the port boiler three furnaces. Each furnace is fitted with a centrifugal vaporizing nozzle. The fuel oil is forced through one of the pumps, installed in the engine room to supply the fuel oil settling tanks, to a consumption tank whence the oil flows to a small duplex steam pump, or an injector, which forces it to the vaporisers through a filter and heater. For petroleum loading ports in which no boiler fire is permitted, the steam required is supplied to the auxiliary engines through a special piping connection from shore.

The auxiliary engines of the vessel such as the windlass, warping engines, etc., which are not used on the open sea, are also operated by steam.

The rudder engine is operated at sea with compressed air and in river navigation, where the boiler must be in operation, steam is used. The compressed air for the rudder engine is supplied by a two stage compressor which is attached to one of the two main engines and operated by a lever. The air is stored in a special rudder air container in order to mitigate the pressure fluctuations when shifting the helm. In addition to the provision for switching the rudder engines from air to steam, which is effected at the engine itself, arrangements are made so that compressed air can also be used to drive all steam auxiliaries. This is important in cases of emergency when there is not sufficient time to get up steam. Even the large oil loading pumps have been successfully supplied with compressed air in continuous operation, this compressed air having been supplied by the auxiliary compressor of the Diesel plant. The hand and steam steering apparatus is arranged on the shelter deck in a special wheel house. It has a quadrant, which is coupled with the tiller by means of springs, as well as a rudder brake. The rudder engine is driven by means of a telemotor from the bridge.

To produce the electric current of 110 volts, for power and illuminating purposes, 2 equipments are provided:

1. A dynamo, operated by a 40 horsepower, crude oil engine at 320 revolutions per minute, which is installed in the engine room and
2. A dynamo operated by a two-cylinder compound steam engine of 40 horsepower at 250 revolutions per minute. With the free end of the dynamo shaft an emergency compressor can be coupled, serving to fill the air flasks in case the supply of air should be entirely exhausted. This engine is installed on the second deck adjacent to the boilers.



Cross Sections of Main Engine

The additional pumps installed in the engine room are as follows:

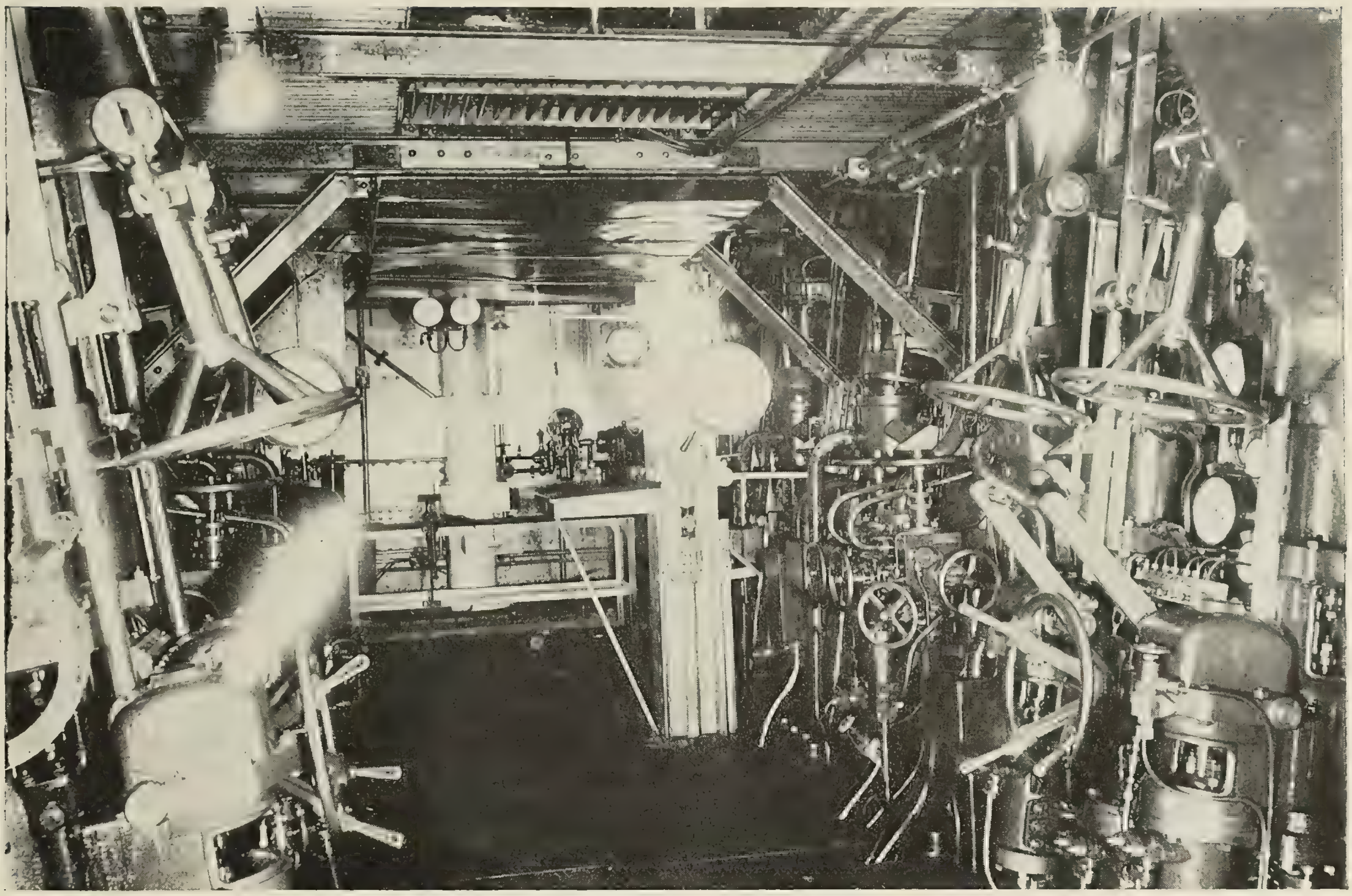
Two duplex steam pumps, also equipped for compressed air, for pumping ballast and to act as an addition for cylinder cooling. Capacity of each pump, about 120 tons per hour.

One electrically driven, centrifugal ballast pump.

One electrically driven, centrifugal pump of 35 tons per hour capacity, against a head of 196 feet 10 inches, used chiefly for deck washing purposes.

Two vertical, electrically driven, reserve geared lubricating oil pumps for the main engines with a capacity of 10 tons per hour against a 65-foot 7-inch head.

The exhaust steam of all auxiliary engines operated by steam is led to an auxiliary condenser of 592 square feet cooling surface located on the second deck. The auxiliaries



Operating Station in Engine Room

can also be operated non-condensing, in order to render possible mixed air and steam operation during the change from one to the other.

On the second deck, alongside the condenser, is an evaporator with a capacity of 15 tons per 24 hours.

Besides the customary apparatus to transmit orders such as the engine telegraph, including reserve telegraph, rudder telegraph, speaking tubes, etc., there is also a system of loud-speaking telephones which connect the bridge, engine room, boiler room and wheel house. This system has proven very satisfactory.

Fuel Oil

Fuel oil amounting to 900 tons is carried in transverse bunkers forward of the engine room and two tanks built into the structure on the second deck outboard of the engine casing. A small portion of the fuel oil is also carried in the double bottom below the engine room.

Two settling tanks with a capacity of 17 tons each are provided. The settling tanks are served by either a small electrically driven piston pump with a capacity of about 20 tons per hour against a head of 98 feet 5 inches or a duplex steam pump with a capacity of 120 tons per hour.

Operation

The trials of the *Zoppot* were held in July, 1920, and resulted very satisfactorily. Data collected at the trials are as follows:

Vessel loaded so that propellers remained 20 inches under water.
Engines worked quietly with no noticeable vibration amidships.
Average indicated pressure 5.5 atmospheres.
Total indicated horsepower, 3,800.
Injection pressure, 55 atmospheres.
Scavenging pressure, 0.15 atmosphere.
Lubricating oil pressure, 0.7 atmosphere.
The high pressure air left the injection pump with a temperature of 20 degrees C., the various cylinder cooling water outlet temperatures fluctuated between 30 and 35 degrees and that of the piston cooling amounted to 40 degrees C.

A slow test trip was made and the engines were reduced to 50 revolutions per minute when using 6 cylinders and 37 revolutions per minute when using 3 cylinders.

The vessel started on its maiden voyage to New York on July 31, 1920.

During the maiden voyage the daily average revolutions per minute fluctuated between 94 and 103. The lowest ship's run for 24 hours was 237 sea miles, corresponding to 9.7 sea miles speed, and the highest 265 sea miles corresponding to 10.9 sea miles speed per hour. The average speed was 10.53 sea miles with a total distance of 3,838 sea miles and the fuel consumption was as follows:

95 R.P.M. — 3,100 I.H.P. = .329 lbs. per I.H.P. hour
99 R.P.M. — 3,500 I.H.P. = .306 lbs. per I.H.P. hour
105 R.P.M. — 4,000 I.H.P. = .300 lbs. per I.H.P. hour

The reduction in the fuel consumption with increasing power, despite simultaneously increasing length of the operating period, showed that the machines were far from their overload limit and that the combustion always remained entirely satisfactory. Both these factors are of the greatest importance to the life of the engines in practical operation. The actual power limit of the engines is very much higher. In former tests on land, continued power of 6,200 indicated horsepower was obtained.

Since then the *Zoppot* has been in continual service with the exception of a 21-day stay at Ponta Delgada, where after towing in the S. S. *Baltic*, it had to wait for fuel oil, and a stay of 19 days in New York for the installation of heating coils in the cargo oil tanks.

Externally the *Zoppot* has no essential characteristics different from those of a steamer as a funnel of normal size

is fitted through which the exhaust pipes and the smokestack of the auxiliary boilers are led. The smokestack, during the time it is in operation, has an easily installable spark catcher which is used in oil ports where boiler operation is permitted only if certain measures of precaution are observed.

Two masts are fitted and aside from fulfilling their signal duties, they serve for the suspension of the antennæ for the wireless equipment. Lightning arresters are provided on the masts.

Four lifeboats and a small boat, 18 feet in length, are carried and suffice for a crew of not less than 62 men.

Independence Tests Her Oil Burners

The electric drive cargo ship *Independence* made a special trial trip on January 6 for the purpose of determining the evaporative power of her boilers and the efficiency of her oil burners. This vessel, owned by the Shipping Board, which was recently converted into a turbo electrically driven ship at the Tebo Yacht Basin of the Todd Shipyards Corporation, has a deadweight capacity of 11,868 tons on a length of 440 feet. Mr. H. B. Taylor, chief turbine engineer for the United States Shipping Board, was in charge of the trial.

It was the purpose of the trial to determine the steaming power of the boilers rather than the efficiency of the turbine and electrical equipment and, therefore, steam was admitted to all the auxiliary lines including those to the deck winches. Steam also escaped from the safety valve continuously so that any figures given for the consumption of steam by the turbine would be erroneous and misleading. However, it should be noted that the propelling machinery worked with precision and gave no trouble.

The vessel is equipped with three single-ended Scotch boilers fitted with the Peabody-Fisher oil burners, high degree firetube superheaters and Diamond soot blowers. CO_2 recorders for determining the quality of the combustion are also fitted.

The Oil Burners

The oil burners are of the mechanical atomizer type. A special feature of this burner is its power, through a by-pass adjustment, of maintaining the whirling motion which atomizes the oil in the central chamber of the tip undiminished whatever may be the capacity desired of the burner. This is accomplished by diverting or by-passing a part of the oil supply from the central chamber and returning it to the pump suction. In this method the amount of oil which is sprayed into the furnace depends on the proportion of the oil that is by-passed to the total amount entering the burner. With this system the amount of oil entering the central chamber is always the same, so that the whirling of the oil and the atomizing effect remain constant, securing a good spray over a wide range of combustion.

It will be seen from the accompanying table that 55,400 pounds of water were actually evaporated per hour from 1:45 to 4 o'clock and that during this time 4,500 pounds of oil per hour were consumed. This gives an actual evaporation of approximately 12.32 pounds of water per pound of oil but it is to be noted that the temperature of the feed water was only 170 degrees. This low temperature of the feed water was caused by the arrangement of the measuring tanks which were installed on the boat deck. The evaporation per pound of oil from and at 212 degrees Fahrenheit was therefore about 14.85 pounds of water per pound of oil.

Still further, an analysis of samples of the fuel oil showed that there were only 17,931 British thermal units as compared with an average value of 18,500 British thermal units for good oil. With oil having a thermal value of 18,500, the evaporation from and at 212 degrees Fahrenheit would be 15.33 pounds of water per pound of oil, which would give the boiler an efficiency of 80.4 percent.

In connection with the superheaters, attention is called to the high degree of superheat maintained. It is also to be noted that the results obtained in boiler evaporation were materially better after the tubes had been blown than they were in the earlier part of the run. The writer was not at all surprised at this after witnessing the amount of soot escaping from the front of the fireroom while one boiler was being blown and the dense clouds escaping from the stack while the process was going on in the others.

It is estimated that an evaporation of 45,000 pounds of water per hour is sufficient for the requirements of the turbine at full load. During the test, as will be noted, the water actually evaporated was 55,400 pounds per hour. The oil consumed was measured by meter readings and by actual soundings taken from the service tanks. From the official soundings taken during the afternoon the average consumption of oil was found to be 4,500 pounds per hour. The results of the test are shown in the following table:

PERFORMANCE OF PEABODY-FISHER BURNERS. TEST ON S. S. INDEPENDENCE, JANUARY 6, 1922

Engine Room and Fire Room Data and General Notes

Item		Time 11:30	12:00	12:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00
Oil (lbs.) pressure	At pump	178	325	325	325	300	275	300	310	290	300
	At burners	125	200	250	250	225	215	225	225	210	225
Oil temperature		208°	199°	275°	250°	270°	255°	240°	230°	240°	235°
Air pressure inches	At fan	1⅛"	1¾"	1¾"	1¾"	1¾"	1¼"	1¼"	1¼"	1⅜"	1⅜"
	In wind box	...	...	...	...	...	+.30"	...	...	+.33"	...
	In front	...	...	...	...	...	+.07"	...	...	+.11"	...
	In furnace	...	...	...	...	...	—.13"	...	...	—.12"	...
Steam pressure	Boiler	210	202	210	215	215	215	215	210	215	215
	Throttle	200	196	200	205	205	203	210	200	205	205
Steam temp. (°F.)	F. boiler	560	700	720	720	720	660	670	610	615	615
	C. boiler	580	740	760	780	780	700	720	620	640	640
	S. boiler	610	770	800	800	790	700	730	620	610	610
	Throttle	500	620	670	640	640	590	600	550	550	560
Fire room temperature (°F.)		74	72	74	72	Thermometer moved to center of fire room			84	87	84
Uptake temperature (°F.)		430	550	580	580	580	520	540	430	430	430
Temperature, water (°F.)	M. tonks	...	98	...	95	...	91	...	90	90	88
	Hot-well	125	94	85	95	96	102	97	90	100	96
	Feed	178	165	157	178	160	170	176	162	174	163*
Shaft r.p.m.		90	95	100	100	100	100	100	100	100	100
CO_2 (%)	Stack	...	...	12.2	12.1	12.6	11.0	11.4	...	...	...
	Tube door	...	...	...	...	...	...	...	14.8	12.8	...
Water level in boilers	P.	11½"	...	...	...	...	...	...	...	...	14"
	C.	6½"	Water level in inches above bottom of gage glass.					...	...	...	8½"
	S.	6½"	...	...	...	...	...	...	...	...	13"

Weather conditions—Clear, moderate winds, sea calm.
Tubes blown—2.40 to 2.55.
By-pass opened to maneuver at 4.11.
Oil used—1.45 to 4.00—4,500 lbs. per hour (official).
Water actually evap.—1.45 to 4.00: 55,400 lbs. per hour (official).
Factor of evap.—1.205. Boiler efficiency—82.5% (official).

*The low feed temperatures were caused by the arrangement of the measuring tanks.

Oil Engines Versus Steam for Tugboats

By H. A. Christensen

With a general depression in shipping and thousands of ships being laid up all over the world, a remarkable strength and steadiness has been shown by the motorship, since practically all ships of that type are still in commission and earning good money for their owners. This condition refers not only to ocean-going vessels, but also to the small, but not less important, craft that keep things moving in harbors, rivers and canals. Since numerous articles have lately been written about ocean-going motorships, this article will deal with the development of oil-engined tugboats.

INLAND water transportation has shown a much steadier condition during the general depression than has trans-oceanic traffic. In fact a substantial increase in inland water transportation seems imminent. The Ford Motor Company, it is reported, is planning to distribute its product by oil-engined craft and many more will follow suit as soon as the economy of such vessels becomes generally known.

Good examples have been set along these lines by such countries as Holland, Germany and France, where efficient water transportation is of the utmost importance. In spite of the fact that these countries have to import practically all their fuel oil, they have long ago adopted the crude oil motor as the motive power for river and harbor vessels. Although

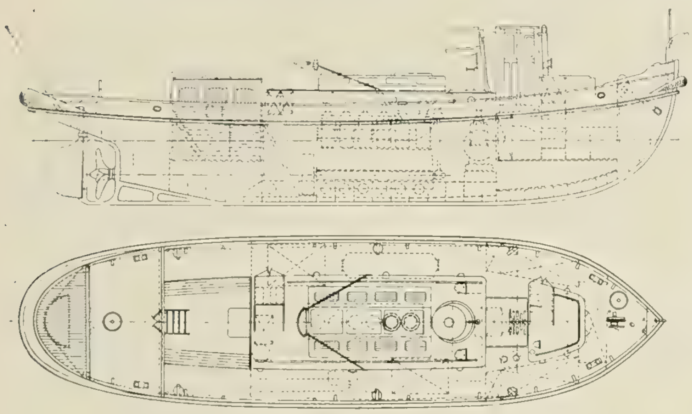


Fig. 1

America is the greatest oil-producing country in the world, we have not yet taken the lead in this respect. The reason is that, during the war, when anything that would float could be operated at a profit, nobody had time to make any changes in their propelling machinery. But conditions have now changed. It will be the owner who has made a thorough study of his problem and who has adopted the most economical form of motive power that will be able to operate his boats at a profit, while competitive boats are laid up.

Advantages of Motor Tugboats

From actual working data of existing motor tugboats the following advantages for the oil engine have been established:

1. As for large ships, the fuel consumption being between 0.4 and 0.5 pound per brake horsepower hour, the cost of fuel is well below one-half the cost of a steam installation.
2. The weight of an oil engine installation is less than that of a steam installation. This means that the dimensions of the oil-engined tug can be reduced, compared with the dimensions of a steam tug of the same horsepower. This of course means a cheaper boat.
3. Stand-by losses are eliminated in oil-engined tugs, since it takes only a few minutes to start up the oil engine, whereas a steam tug must have the fires burning continuously.
4. Compared with a steam tug of the same dimensions and horsepower the oil-engined tug can carry more fuel and will thus have a greater cruising radius, due to the lighter engines.
5. No firemen are required on an oil-engined tug, giving a saving in the crew's wages.

We shall now describe a few representative tugboats that will substantiate the claims just brought up.

German Motor Towboat

Fig. 1 shows a Diesel tugboat for harbor service that has been in use at the Government shipyard at Wilhelmshaven, Germany, for over three years. The boat was built by the Hitzler Shipyards at Lauenburg, Germany.

The principal dimensions are:

Length overall	52 feet 6 inches
Length between perpendiculars	45 feet 11 inches
Beam	13 feet 1½ inches
Depth	6 feet 3 inches
Draft	4 feet 7 inches

A steam tug with the same horsepower would require an addition to the length of about 3 feet and an addition to the beam of about 1 foot due to the larger weight of the steam outfit. This boat is built to the German Lloyds rules and is also designed as an icebreaker.

In order to enable the boat to pass under bridges, the superstructure as well as the smokestack was kept low. Four watertight bulkheads divide the boat into fore peak, crew's quarters, engine room, cabin and after peak.

Instead of a towing engine or towing bitt, as used on many American tugs, a towing hook is used. This hook is located near the center of gravity of the boat, which makes steering easier. This is the more important as most of the towing in Europe is done with the lighters astern of the tug and the practice of making fast alongside of the lighter is hardly ever used.

The machinery consists of one direct reversible two-cycle Diesel engine of 100 brake horsepower. The engine makes 250 revolutions per minute, although it will run smoothly at 70 revolutions.

The engine has four working cylinders, each provided with an independent fuel oil pump and two air pump cylinders placed on the centerline of the engine. The engines are reversed by compressed air from the air tanks, which are of sufficient capacity to reverse the engine twenty times without requiring refilling.

The auxiliary air compressor is driven by a 5 horsepower hot bulb engine that also handles the bilge and fire pump. The cylinders are water cooled by a pump, driven directly from the crank shaft.

The fuel consumption of the main engine using fuel oil of a heating value of about 18,000 British thermal units per pound has averaged 47.4 pounds per hour. The boat can carry fuel oil sufficient for a trip of 500 sea miles. A steam tug of the same size can carry only a few tons of coal, sufficient for about 175 sea miles, on account of the heavier steam installation.

The time used for reversing on the trial trip was about six

seconds from full speed ahead to full speed astern, and the average speed was nine knots.

American Motor Tug

The *Marie L. Hanlon,* one of the first American motor tugs, is shown in Fig. 2. She was built in 1913 by D. J. Hanlon of Oakland, Cal., and is fitted with one direct reversible Bolinder engine of 160 horsepower and 224 revolutions per minute.

A very close comparison with a steam tug could be made in this case as the owner had a steam tug of the same dimensions:

Length overall	71 feet 5 inches
Beam	17 feet 5 inches
Depth	8 feet 5½ inches
Draft, average	6 feet 6 inches

The steam installation consisted of a Scotch boiler 7 feet 6 inches in diameter and 9 feet long and a compound engine 10 inches by 20 inches by 18 inches. On account of her large engine space the steam tug carries only 18 barrels of oil, which, on a fuel consumption of 42 gallons an hour and a speed of 10½ miles, gives her a steaming radius of only 189 miles. Her sister ship carries 38 barrels of fuel oil and with a fuel consumption of 13.7 gallons per hour she has a radius of 1,565 miles.

The machinery weights in this case are given as 450 pounds per horsepower for the steam installation and 170 pounds for the motor.

The lower fuel consumption and the elimination of the fireman are claimed to bring the operating expenses of the motor tug down to about one-half those of the steam tug.

Danish Motor Tugboat

Fig. 3 shows a Danish wooden tugboat for harbor service. This boat has been in use in the harbor of Copenhagen for the past two years. Its principal dimensions are:

Length overall	52 feet 6 inches
Length between perpendiculars	47 feet 0 inches
Beam	13 feet 0 inches
Depth	7 feet 6 inches
Draft	4 feet 9 inches

This boat is provided with an 80 horsepower Volund hot bulb reversible engine which makes 250 revolutions per minute.

The fuel consumption of the engine with Solar oil of 18,000 British thermal units heating value is about 43 pounds per hour. The weight of the engine is 180 pounds per horsepower, and it takes exactly eight minutes to start it, from the moment the blow lamps are lighted.

The crew consists of three men and the boat makes an average speed of 9 sea miles an hour.

The absence of auxiliaries and the simple construction as well as lower weight of these engines compare very favorably with Diesel tugs of the same size, whereas the Diesel even in the small sizes has the advantage of a slightly lower fuel consumption. The first cost of a hot bulb engine is lower than that of a Diesel engine.

A steam installation in a boat of this size would take up more than half of the crew's quarters and it would also necessitate a larger deck house.

French Motor Tugboat

Fig. 4 shows a powerful Diesel-engined tugboat built for service on French rivers. Not less than sixteen of these tugs were built during the war by the French Government.

The principal dimensions are:

Length overall	91 feet 10 inches
Length between perpendiculars	85 feet 3 inches
Beam	16 feet 8 inches
Draft	9 feet 10 inches

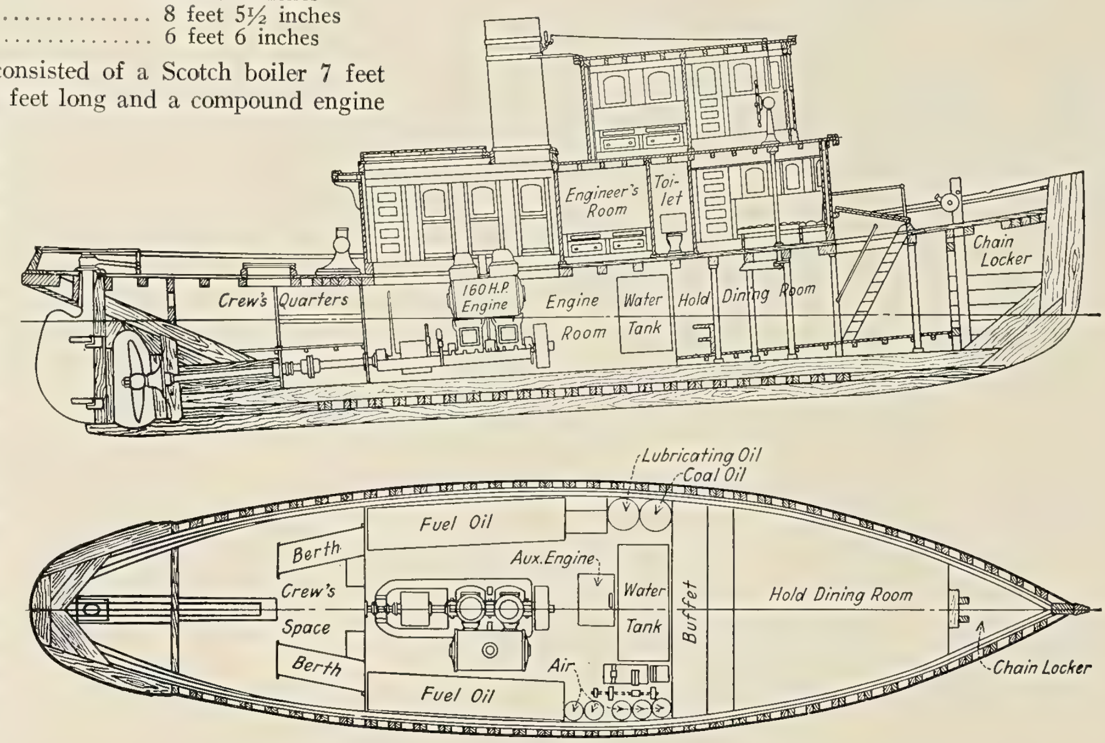


Fig. 2

Displacement	143 tons
Fuel capacity, about	10½ tons

Ten of these boats are propelled by two-cycle Diesel engines of 420 brake horsepower making about 220 revolutions per minute. The fuel consumption of these engines is 0.38 pound of crude oil per brake horsepower hour. The auxiliary air compressor and the electric lighting are handled by a 12 horsepower Diesel engine. The engines are of the Sulzer design, built by the Forges et Chantiers de la Mediterranee, Paris.

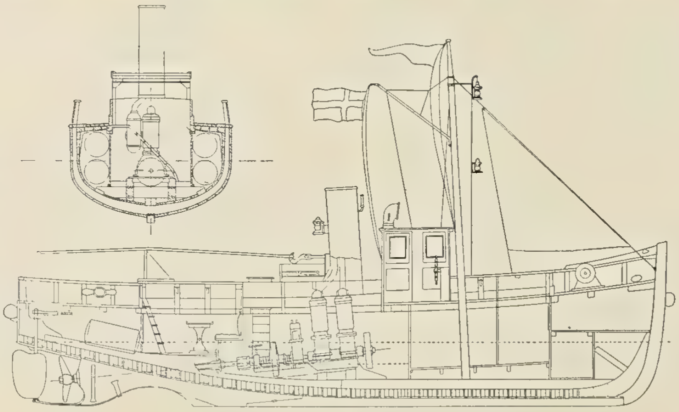


Fig. 3

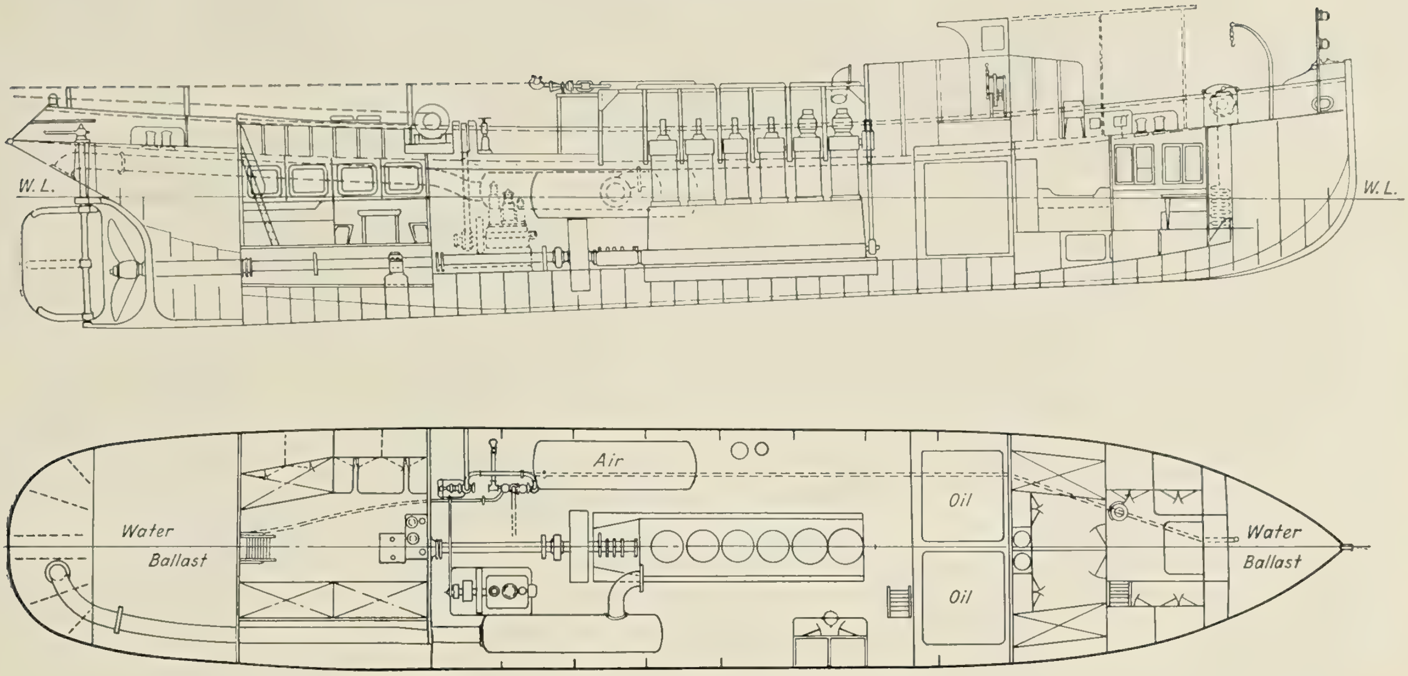


Fig. 4

Six of the boats are propelled by 350 horsepower Polar Diesel engines making 200 revolutions per minute. On account of the smaller engines on these boats their displacement has been decreased by about five tons.

German Motor Tugboat

Fig. 5 shows an ocean-going tug, two of which were built in 1916 by the Atlaswerken in Bremen, Germany.

The principal dimensions are:

Length overall	77 feet 7 inches
Length between perpendiculars	69 feet 6 inches
Beam	18 feet 0 inch
Depth	11 feet 2 inches
Draft, aft	9 feet 6 inches

The boats were designed for ocean as well as for harbor service. They carry 17.7 tons of fuel oil, giving them a radius of about 2,500 miles. A steam tug with its heavier engine and with the same amount of fuel would require much larger dimensions.

The propelling machinery consists of one two-cycle Diesel engine of 350 horsepower, with 180 revolutions per minute. The steering engine, the windlass and the whistle are handled by compressed air from an air compressor driven by a 30 horsepower Diesel engine. According to the German Lloyds rules the boats also have an auxiliary air compressor driven by a 5 horsepower hot bulb engine.

The smokestack is provided with a number of baffle plates that continuously change the speed and direction of the exhaust gases, thus considerably reducing the noise from the exhaust.

These tugboats, one of which has been in service for seven years, have rendered excellent service. No large repairs have been required during that time.

The engines were built by the firm of Benz & Cie., Manheim.

Swedish Motor Salvage Vessel

Fig. 6 shows the Swedish salvage vessel *Fritiof*. Although she is built for salvage work, she possesses all the features of a large ocean going tugboat.

The principal dimensions are given on the following page.

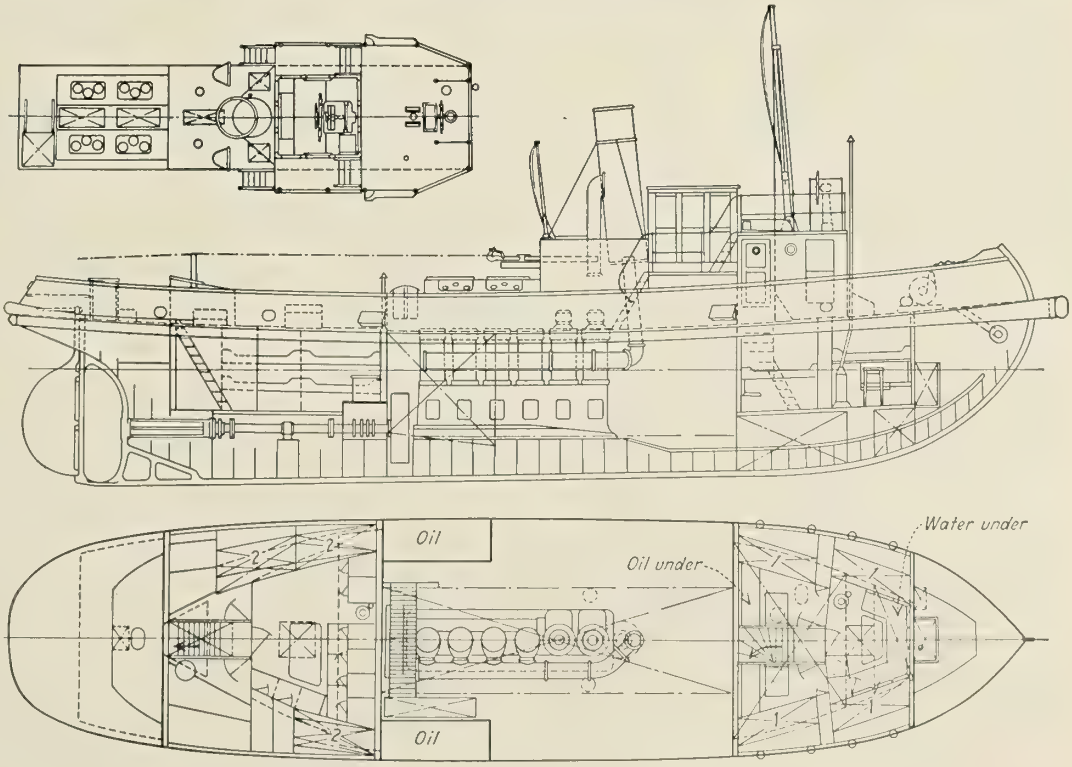


Fig. 5

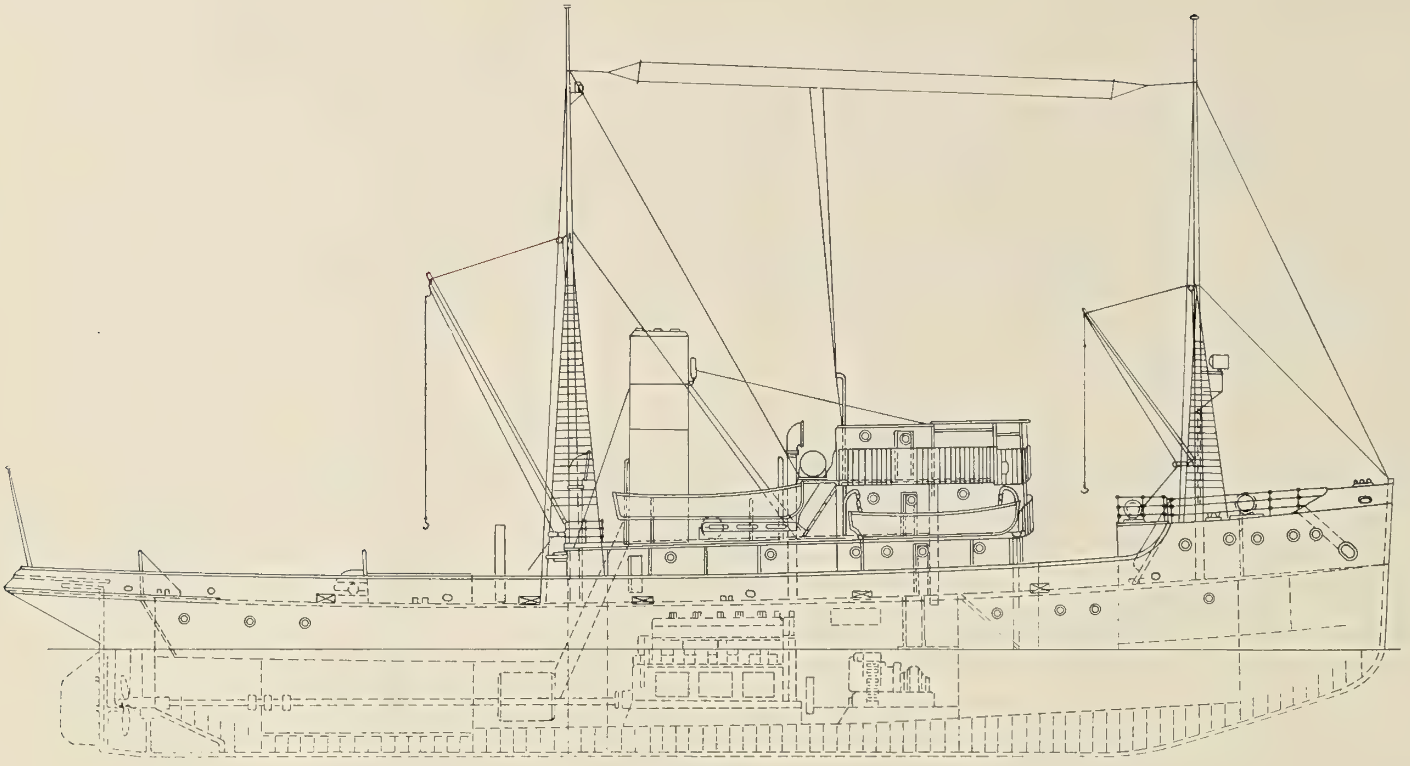


Fig. 6

Length between perpendiculars	156 feet 11 inches
Beam	34 feet 9 inches
Depth	18 feet 7 inches
Draft	13 feet 5 inches

The machinery consists of two four-cycle Diesel engines of 625 horsepower each, of the Burmeister & Wain type built by Gotaverken, Sweden, and three Diesel engines of 90 horsepower each coupled with a dynamo. Besides the usual auxiliary equipment for a Diesel installation, there are two 14-inch salvage pumps, three 8-inch portable pumps, one 12-inch steam driven pump and two portable plunger pumps. The steering engine, the cargo winches and the towing engine are steam driven. Steam is supplied by one Scotch boiler and one portable boiler.

Built as an icebreaker and with a forecastle giving added seaworthiness she can be looked upon as an excellent all round type of a large ocean going tug.

The principal reason for using motors in this case has been the fact that she will be ready to start on a trip at short notice, a fact that greatly increases her value for salvage purposes. She can also carry more fuel than a steamer of the same dimensions, which is especially important for long distance towing.

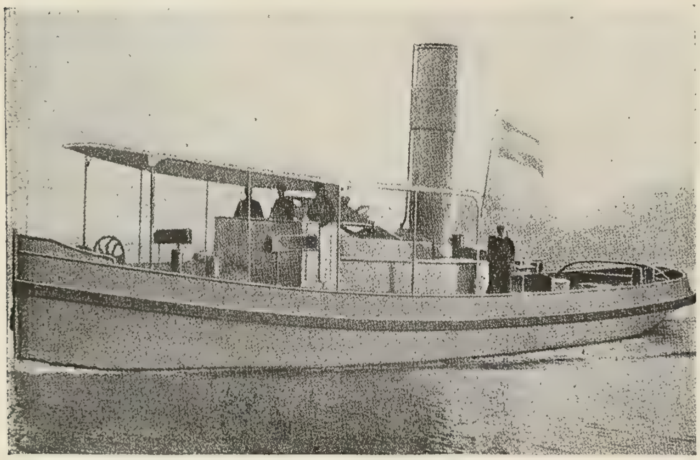


Fig. 7.—East Indian Harbor Motor Tug

East Indian Motor Tugboat

A small tug for harbor service in the East Indies is shown in Fig. 7. It was built by the shipyard of Nicolaas Witson, Alkmaar, Holland, and is 59 feet 9 inches long between perpendiculars with a beam of 14 feet 9 inches.

The boat is propelled by a two-cycle Diesel engine of 160 horsepower at 250 revolutions per minute. A small hot bulb engine of 6 horsepower at 650 revolutions per minute drives a centrifugal pump in the engine room.

As in all Diesel tugs there is ample room for fuel tanks and, with the approximately 1,300 gallons that she carries, this boat can run over 1,100 sea miles without refilling the tanks.

The awnings which cover the entire forward part of the deck and an extra large engine room skylight are special features for service in the tropics.

Conclusion

Judging from the data just shown for various oil-engined tugboats in actual use in the principal maritime countries, this type of tugboat certainly offers many advantages over the steam tug. War conditions in shipping have passed, and we are forced to compete with other nations that are not slow to grasp opportunities to decrease their operating expenses. We Americans, with our higher wages and standard of living, should be interested more than anybody else to find ways and means to remove this handicap by adopting equipment that is equal or better than that used by our competitors.

George E. Bunting, Australasian manager for the Canadian Government Merchant Marine, Ltd., who will act as general traffic agent for the Canadian National Railways, will have general supervision in New Zealand and Australia of the traffic interests of these railways.

Theodore J. Pick, for several years chief clerk of the Terminal Shipping Company, has been appointed operating manager of the Williams Steamship Company in Baltimore.

24182

American Coastwise Motor Tug

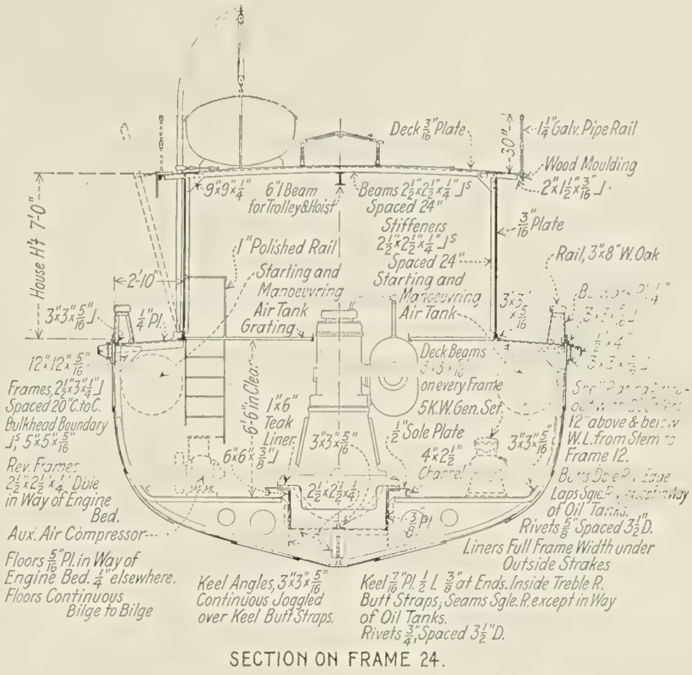
By Edward A. Edwards*

THE very remarkable increase in the use of the oil engine for marine purposes during the past eight years has extended to nearly every type of vessel, large and small, in every kind of service and its great advantages over the cumbersome and far less economical steam plant are being recognized by the operators of tugs, lighters and other small craft which play a more humble though none the less important part in our general system of marine transportation. The steadily increasing number of motor tugs going into service is a pretty sure indication that this type is giving reliable and satisfactory performance along with its undoubted superiority in the matter of operating economy.

The plans show a 300 horsepower motor tug designed by the writer for the Diamond P Boat Line of Philadelphia and intended for general coastwise and inland towing. The draft has been limited to 7 feet for canal work but the boat has plenty of sheer and freeboard so that outside trips can be made with comfort and safety.

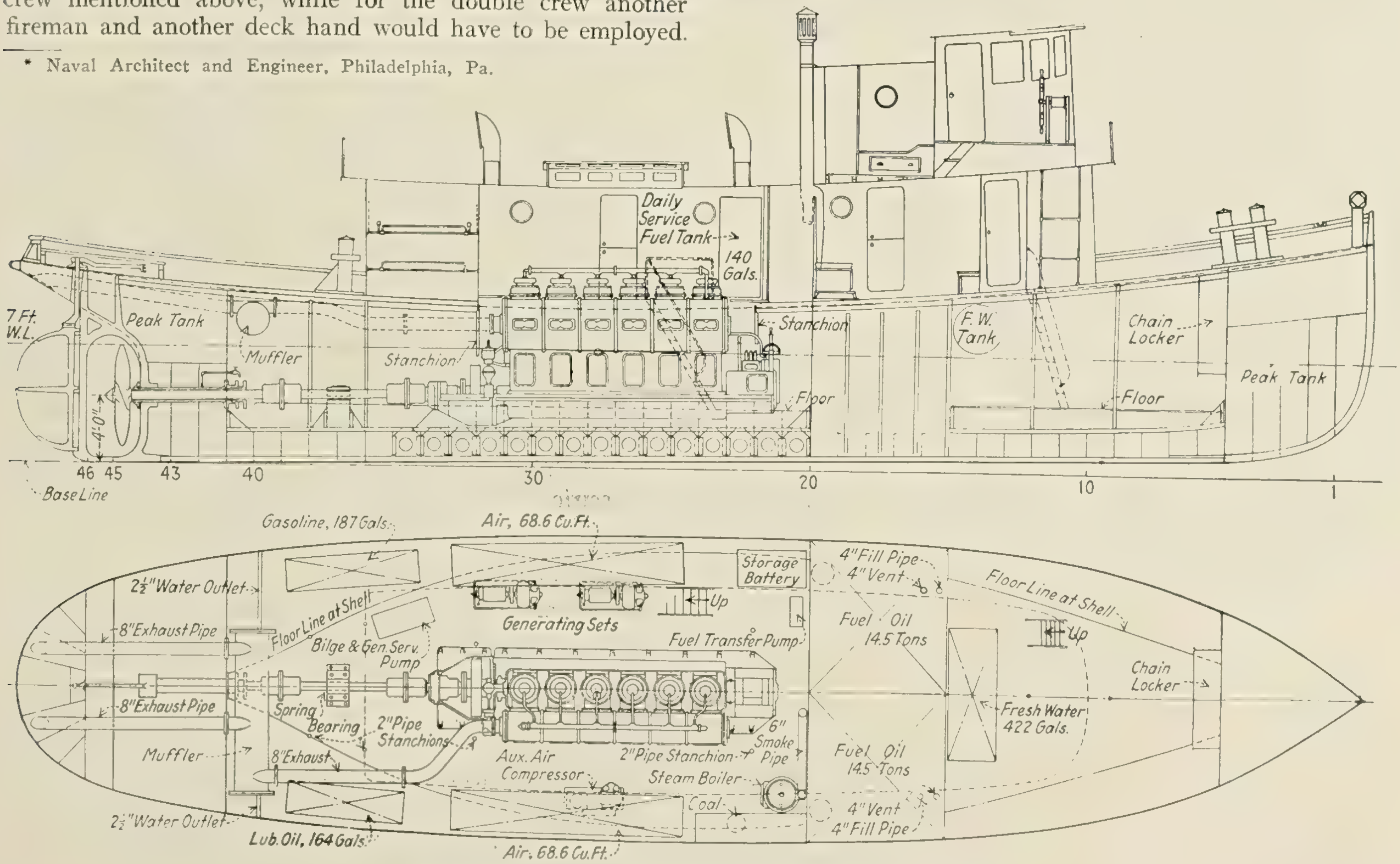
In order to realize fully the advantages of this tug over a steam vessel of the same power it should be noted that, according to the United States Steamboat Inspection Service regulations now in force, a motor vessel used exclusively for towing purposes requires no inspection and no licensed officers. The captain of a boat of this kind, however, would be a licensed pilot in any case. A single crew for the tug shown here consists of only four men; captain, engineer, deck hand and cook, while a double crew for 24 hour service would ordinarily add two more, a mate and an assistant engineer, although one well known boat of this type has been working up and down the coast for the past two years all the way from Florida to Maine with a total double crew of only five men, one of whom acts either as second engineer or deck hand as occasion demands. A steam tug of this size would have to carry two firemen in addition to the single crew mentioned above, while for the double crew another fireman and another deck hand would have to be employed.

The fuel consumption of the 300 shaft horsepower main engine is approximately 22 gallons per hour at full load, so that with 30 tons of oil in her bunkers this tug can run at full power for over 400 hours. Working 10 hours per day this means that the boat will require bunkering only once in forty days, while in 24 hour service she can be run at full power for 17 days. These figures should be interesting to the owner of the average steam tug which loses practically half a day every five or six days in filling up her coal bunkers.



Midship Section of American Motor Tug

* Naval Architect and Engineer, Philadelphia, Pa.



Design for 300 Horsepower American Motor Tug

American Coastwise and Inland Motor Tug

General Information

Service: Towing ....
....
....
Builder: ....
....
....
Owner: Diamond P Boat Line, Pier 45, N. Wharves, Philadelphia............

Characteristics

Length, overall	82′ 6″
Length, B. P.	73′ 6″
Breadth, molded	18′ 6″
Depth, molded	9′ 0″
Draft, loaded	7′ 0″
Draft, light	
Block coefficient	0.454
Midship section coefficient	0.711
Longitudinal coefficient	0.638
Speed, loaded, knots	
Cruising radius, nautical miles	
Framing	Transverse
Class	

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	70
**Weight Propelling Machinery	27
Deadweight Capacity	
Displacement	123.5

(In tons of 100 cubic feet)

Gross register	
Net register	

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.
**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Equipment

Anchors: 1 ....500 lbs.
1 ....250 lbs.

Chain: 60 fathoms ....11/16″ S. L.
60 fathoms ....½″ C. L.

Rudder

Area	19.41 sq. ft.
Dia. Stock	3″
C. Press. abaft C. L. pintles	21″

Complement

Deck officers	2
Deck crew	1
Engineer officers	
Engineer crew	1
Purser's and steward's department	1
	—
Total officers and crew	5

Deck Machinery

Steering Gear	Hand
Windlass	
Capstans	
Winches	

Life Saving Equipment

	No.	Type	Length
Lifeboats	1	steel	14′

Engines

Number	1
Type	Moderate Compr. Oil
Size	6 cyl., 14″ bore, 18″ stroke
Horsepower, shaft	300

Normal fuel consumption, main engine:
Per day, tons 1.8
Per horsepower hour, pounds........0.56

Propellers

Number	1
Type	4-blade
Weight	
Diameter	72″
Pitch	56″
R. P. M.	250
Projected area	
Developed area	

Auxiliary Machinery

Machinery Space

Pumps:
One 2″ Blackmer rotary bilge and general service pump direct connected to 3 h.p. electric motor.

One ¾″ Blackmer rotary fuel transfer pump direct conected to ½ h. p. electric motor.

One 4½x5 air compressor driven by 5 h.p. electric motor.

Electric Equipment

Generators:
Two 5 K.W. sets for driving auxiliaries and for lighting.

Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons
Port	580		14.5
Starboard	580		14.5

*40 cu. ft. per ton;..............gals, per bbl.

In addition to the above outlined advantages it should be remembered that the motor tug is always ready for instant service, there being no time loss while getting up steam. In addition there are no stand-by losses, no ashes to handle, no dirt and no choked bilges to clean out.

One of the features of this boat which should have special mention, and which overcomes one of the most frequently raised objections to the motor tug, is the Sperry electro-magnetic clutch which will probably be installed for the purpose of securing added flexibility and maneuvering power. This clutch is a recent development of the Sperry Gyroscope Company and is installed in place of the flywheel on the after end of the main engine, adding practically nothing to the space and very little to the weight. It requires less than three amperes of current at 110 volts to transmit the full power of the engine. The transmission is through an air gap, not by any clamping of plates, thus giving that perfect flexibility which is the main advantage of the electric drive. The current through the clutch coils is controlled by a rheostat placed close to the other engine controls and also in the pilot house if desired, enabling either the pilot or the engineer to bring the propeller shaft from zero up to full revolutions, or vice versa, as gradually as may be desired and with absolute freedom from jar or shock.

Hull

The principal dimensions of the tug are as follows:

Length, overall	82 feet 6 inches
Breadth, molded	18 feet 6 inches
Depth, molded	9 feet
Draft with 28 tons fuel	7 feet
Shaft horsepower	300

The scantlings are in excess of American Bureau or Lloyd's requirements. There are four oil tight transverse bulkheads, two forming the peak tanks and two the main fuel bunkers. The fuel compartment is also divided by a centerline longitudinal bulkhead into port and starboard tanks, the combined capacity of which is 29 long tons. Additional fuel may be carried in the peak tanks and two daily service tanks are located in the engine room.

Machinery

The main propelling unit is a 6 cylinder, 14-inch bore, 18-inch stroke, Fairbanks Morse type C-O direct reversible oil engine, conservatively rated at 300 brake horsepower at 250 revolutions per minute. This engine is of the moderate compression, two stroke type with mechanical injection.

The auxiliaries are all electrically operated and consist of one 4½ by 5 Ingersoll-Rand Imperial Type 14 vertical reservoir cooled air compressor connected by short belt drive to a 5 horsepower, 1,150 revolutions per minute Fairbanks Morse type CPB motor; one 2-inch Blackmer rotary bilge and general service pump geared to a 3 horsepower, 1,150 revolutions per minute Fairbanks Morse type CPB motor and one ¾-inch Blackmer rotary fuel transfer pump geared to a one-half horsepower, 1,750 revolutions per minute General Electric type RC motor. All motors are 110 volt direct current, which is supplied by two 5 kilowatt Winton gasoline engine driven generating sets. One of these sets is sufficient for ordinary use and the other is held in reserve.

A slate panel switchboard with circuit breakers and controls for motors and lights is located above the grating in the upper part of the engine room. There is also a 56 cell, 110 volt storage battery for auxiliary lighting purposes.

Starting and maneuvering air at 175 pounds pressure is carried in two tanks, one on each side of the engine room.

A small coal burning steam boiler for heating purposes is located in the forward starboard corner of the engine room.

The complete tug as shown in the plans can be built, fully equipped and delivered to New York or Philadelphia for approximately $60,000 at the present time.

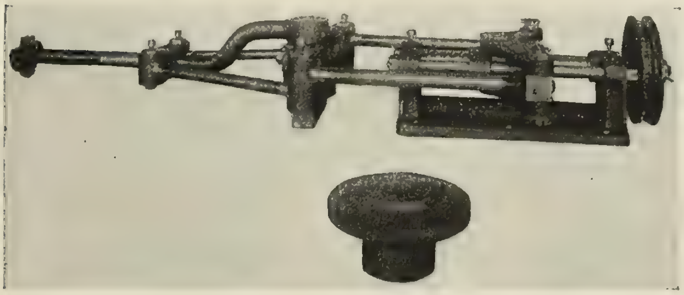
Motorship With a Non-Reversing Engine

Maneuvering Ability Supplied by Kitchen Rudder, the Alca Completes Year of Uninterrupted Service in Congested Harbors

By Alexander McNab*

THE economical advantage of the direct Diesel driven ship is evident by the success already attained. The greatest testimony to ships of this class is the number in successful operation today; voyages are undertaken and

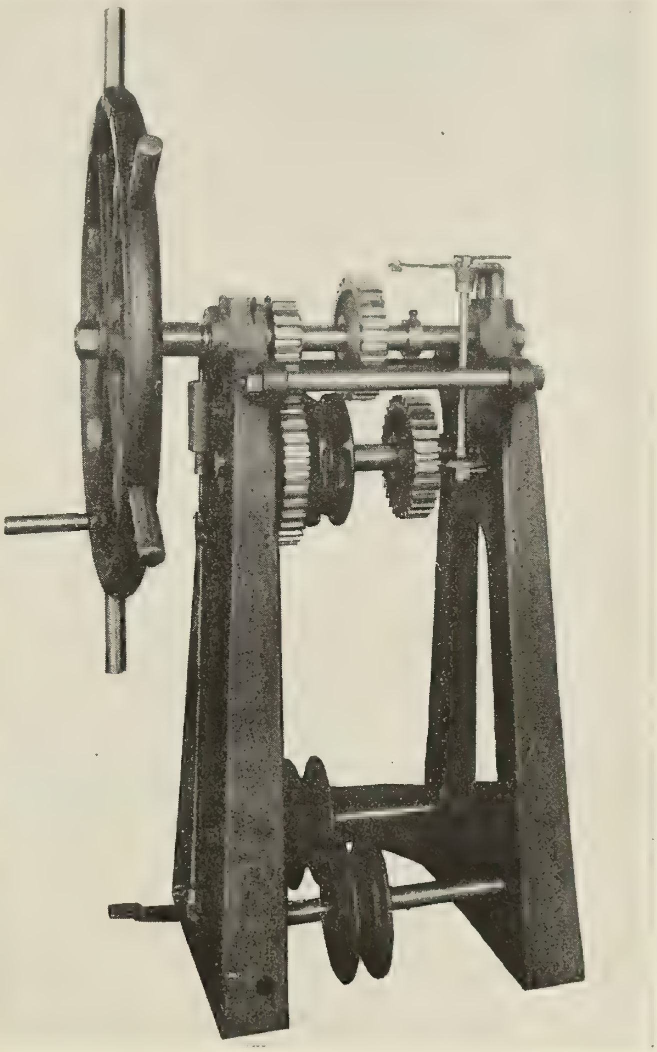
Stern of Motorship Alca, Showing Kitchen Rudder



Steering Gear of Motorship Alca

marine conditions accepted without any trepidation because of the machinery installed.

When Dr. Rudolf Diesel brought out his first engine it was of the land type, being non-reversible. It was therefore natural that marine engineers went to work to make this type of engine reversible before it could be successfully applied to ship propulsion. It may seem preposterous, at this late date, to state that, if more consideration had been given the ship's rudder, there is every reason to believe that the reversing of the reciprocating, turbine or Diesel engine need never have been considered. As a matter of fact, however, vessels



Steering Wheel of Motorship Alca

equipped with Kitchen rudders, which accomplish the reversal of the ship without reversing the engine, are now being successfully operated.

Features of Kitchen Rudder

The essential parts of the Kitchen rudder consist of two curved deflectors, which partially enclose the propeller, both of which are pivoted on top and bottom on common centers. By suitable mechanism, similar in design to the electric-hydraulic type of steering gear, the deflectors or rudders are made to turn together in the same direction or equally in opposite directions. The operation of the rudders is arranged by remote control installed on the bridge, this control can be electric or telemotor.

Over three hundred Kitchen reversing rudder installations have been made and it has been found, from data taken on a

*President of The McNab Company, Member Institute of Marine Engineers.

number of different classes of vessels in operation ranging from the tow boat up to and including the ocean motor freighter, that the maneuvering and steering ability of each ship so equipped is identical.

With this new type of rudder the Diesel engine or steam turbine can be made non-reversible and directly connected to the propeller shaft. During the time that the propeller is rotating full ahead the vessel, fitted with the Kitchen rudder, can be held stationary as if at anchor, can be sent ahead at a speed ranging from the fraction of a knot to maximum speed or can be brought from full speed to dead rest in approximately her own length without shock or strain to rudder, hull or machinery. A single screw ship can be rotated on her own axis to port or starboard without progression, which maneuver is impossible with any other type of rudder, and with propeller running full ahead the vessel is capable of an astern speed of from 28 percent to 35 percent of her ahead speed. The British Admiralty has installed these rudders in a large number of auxiliary craft and, from data taken, it has been reported that the speed of each vessel fitted has been increased from 3 percent to 6 percent over that of the standard type of rudder.

The Motorship Alca

An example of this new form of rudder, as installed on the motorship *Alca,* may be of interest, especially when it was considered doubtful that the installation would be a success due to the low powered land type propelling unit installed. The vessel, however, has now been in continual service for over one year between the Bay of Biscay and Mediterranean ports. The *Alca* is a steel vessel of 500 tons displacement and 300 tons deadweight carrying capacity engaged in carrying coal and general cargo. Her dimensions are as follows:

Length	140 feet
Beam	22 feet 3 inches
Depth, molded	10 feet
Load draft	8 feet 3 inches

Engine, Sulzer Diesel land type (non-reversing), 150 brake horsepower direct connected to a propeller 4 feet in diameter.

The *Alca* was originally built as a sailing vessel; she has now been rerigged and fitted with cargo booms. To install the Kitchen rudder the original rudder post was removed by cutting through at the top and bottom of the propeller aperture, an extension to the stern foot to take the bottom pintle was added and a strong gudgeon was riveted to the hull to receive the rudder stock. The rudder blades are of mild steel plate ½ inch thick, the inside dimensions of the rudder being 64 inches by 58 inches, the major axis being horizontal. The maneuvering and reverse control for operating the rudders is installed in the pilot house. The ordinary type of hand steering wheel is used, this being independent from the maneuvering control. The remote control as installed on the *Alca* is operated manually, power gear not being necessary owing to the low engine brake horsepower and small diameter propeller. The motion from this control is conveyed to the rudder head operating gear by means of steel chains over guide sheaves and rollers; it is this gear which regulates the opening and closing of the rudder blades, thereby regulating the ahead and astern speed of the ship.

During her trials the *Alca* attained a sea speed of 6¼ knots. The following results of maneuvering are interesting:

From full ahead to dead stop, time taken 34 seconds and distance traveled 200 feet.
Diameter of turning circle, rudder 25 degrees hard over at full speed ahead, 140 feet.
Time taken to spin on own axis, as if on a pivot, without progression through half circle, 1 minute 25 seconds.

The owners of the *Alca* report that during the first year of uninterrupted service the rudder control is most efficient and practically instantaneous in effect.

New Danish Motor Lightship

By H. C. Snethlage

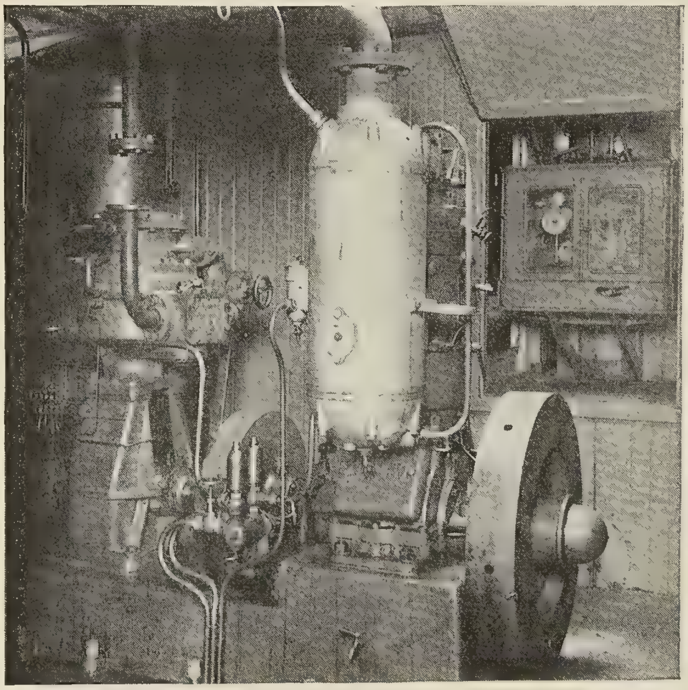
In view of Secretary Hoover's emphatic report that sixteen new lightships are urgently needed, as mentioned in the January issue of this magazine, it will prove interesting to American readers to see photographs of an up-to-date Danish lightship provided with crude oil engines.

This installation is another proof of the absolute reliability of the crude oil engine for marine purposes. The seas around Denmark are very stormy. Ask any captain who has passed

Motor Lightship Halskov-Rev

the "Skaw" on a stormy winter night. And since the power plant on a lightship is apt to be used on just such a stormy night, it is evident that no chances can be taken with machinery that is not absolutely reliable.

Due to the success of large motor merchant ships in Denmark, the Danish lighthouse service decided to investigate if that type of motive power could not be used to advantage on their ships. An 80 horsepower Volund motor manufactured by the Volund Company of Copenhagen was first tried



Motor Compressor for Lightship Fog Horn

out on one of the smaller lighthouse vessels, and since this engine proved satisfactory in every way, all Danish lightships are now provided with that type of motor.

The main propelling machinery consists of a 135 horsepower crude oil motor. It is of the two-cycle, valveless, trunk piston type with a hot bulb, used for ignition, placed on top of the cylinder. An interesting feature of this installation is that no water injection is used. The weight of the machinery is only about 180 pounds per horsepower, which compared with 400 pounds for a steam installation gives a saving of 12 tons in displacement for the motorship.

Not only is the main propelling machinery motor driven but the fog horn is handled by an air compressor direct connected to a 27 horsepower one-cylinder Volund motor as shown in Fig. 2.

This lightship is stationed off the west coast of Jutland, not far from the spot where the greatest naval battle in history was fought. This coast line is not unlike our Atlantic coast line in that there are plenty of opportunities for ships to go on the rocks. The Danes, however, are taking no chances. Equipment as good as can be had is placed in this service. Is there any reason why this country, with resources many times greater than Denmark's, should stand back and let the lives of thousands of people depend on out-of-date lightships, some of which are over 50 years old?

Now is the time when Congress should take action. We have shipyards here second to none. Why should these yards be allowed to be temporarily idle, when new construction of such vital importance to American shipping could easily be done now, thus keeping the highly trained shipyard organizations intact?

We hope that Congress will see this point and that in the near future, lightships of the most modern type will be under construction in our shipyards.

Fire Tube Superheaters Save Fuel on Railroad Tugs

Indicated Horsepower Increased from 5 to 27 Percent—Fuel Consumption Reduced from 15 to 17 Percent—Maintenance Costs Negligible

Fuel economy, increased capacity, greater operating efficiency and freedom from maintenance troubles—advantages claimed for the fire tube superheater—have been convincingly established by the successful operation of high degree superheat on the sea-going tugs *Wyoming, Perth Amboy* and *Lehigh,* formerly owned by the Lehigh Valley Railroad and now owned and operated by the Bee Line Transportation Company.

The *Wyoming,* a vessel of 398 gross tons, 152 feet long, 27 feet 3 inches beam and 16 feet draft, with a towing capacity of 5,000 tons, was the first American boat operating in American waters to be equipped with fire tube superheaters. The *Wyoming* was fitted with superheaters in June, 1915, by The Superheater Company (then the Locomotive Superheater Company), New York.

Economies Effected

In November, 1916, after a series of operating tests on the *Wyoming* had shown a coal saving of 15⅝ percent and an increase in capacity of from 865 indicated horsepower on saturated steam, to 908 indicated horsepower on superheated steam, a second tug, the *Perth Amboy,* was equipped with the same type of superheaters.

Similar and even more careful tests were run on the *Perth Amboy,* and the results compared with saturated steam operation under identical conditions. Superheated, the *Perth Amboy* developed 887 indicated horsepower against 775 indicated horsepower on saturated steam. A fuel saving of 15 percent was shown.

The *Lehigh,* the third of the fleet, was equipped with the same kind of fire tube superheaters in March, 1917. The *Lehigh,* after superheating, developed 803 indicated horsepower against 633 indicated horsepower on saturated steam. On the *Lehigh,* the fuel saving proved to be 17 percent.

Maintenance Costs Practically Nil

Any doubts as to the practicability of the fire tube superheaters for use on this type of vessel are removed by the performance and maintenance records of these superheater-equipped tugs. Over considerable periods of continuous operation, six years in the case of the *Wyoming,* five years on the *Perth Amboy,* and upwards of four years on the *Lehigh,* maintenance costs on the superheater equipment of these vessels have been practically nil.

No trouble has been experienced through the use of cylinder lubrication. The *Perth Amboy* has run two and one-half years on one set of rings in the high pressure cylinder with 180 degrees of superheat. All three ships average 60 to 70 hours on one quart of oil in the forced feed lubricator. Recent examination of the rods, rings and cylinder liners of these superheated tugs showed them to be in excellent condition.

Tug Wyoming, on Which the Installation of Fire Tube Superheaters Cut Down the Fuel Consumption Over 15 Percent

Comparative performances of the Lehigh tugs on saturated and on superheated steam are shown in Table I.

Description of the Superheaters

The fire tube superheater, as installed in the Lehigh Valley Railroad tugs, consists of three pairs of collector castings or headers, located at the uptake end of the boiler, each pair of headers being connected to a group or nest of superheater unit pipes, which run in and out of the boiler smoke tubes. Of each pair of headers one takes the saturated steam as it comes from the boiler and transfers it to the superheater units; the other receives the superheated steam after it has passed through the units on its way to the engines.

In this superheater there is a total of 80 units, arranged in three groups, corresponding to the number of pairs of headers. These groups, each made up of a saturated and a superheated header, with a system of units, are independent in their action, being separated from each other by valves.

TABLE I—COMPARATIVE PERFORMANCES, SATURATED AND SUPERHEATED STEAM, OF LEHIGH VALLEY RAILROAD COMPANY'S TUGS IN TOWING SERVICE

	Lehigh		Perth Amboy		Wyoming	
	Sat. Steam	S. H. Steam	Sat. Steam	S. H. Steam	Sat. Steam	S. H. Steam
Duration of Test	46.92 hr.	85.50 hr.	47.58 hr.	54 hr.	....	138.58 hr.
Number of barges	3	4	3	3	3	3
Total tonnage of tow	3,451	5,149	3,322	3,502	....	3,251
Boiler pressure (lb. sq. in.) (av.)	173	173	186	187.5	175*	175*
M. E. P. H.P. Cyl. (lb. sq. in.)	76.9	95.2	63.5	82.8	79.9*	79*
M. E. P. I. P. Cyl. (lb. sq. in.)	33.8	37.6	40.6	39.7	33.3*	36.5*
M. E. P. L. P. Cyl. (lb. sq. in.)	9.8	12.55	13.7	15.4	10.4*	12.5*
Ref. M. E. P.	32.3	38.6	37.9	42.5	33.7*	37.1*
Vacuum (inches) (av.)	23.5	23.4	24.3	24.8	26*	25*
R. P. M.	87.7	92.3	93	94.8	117*	111*
I. H. P.	633	803	775	887	....	....
Max. I. H. P. (no tow)	....	....	....	....	865*	908*
I. P. Rec. Pres. (lb. sq. in.) (av.)	53.8	58.4	72	65.7	....	....
L. P. Rec. Pres. (lb. sq. in.) (av.)	5.9	6.85	16.4	15.4	....	....
St. Temp. at throttle (av.)	376 F.	575 F.	382 F.	590 F.	377 F.	570 F.
St. Temp. at throttle (max.)	376 F.	625 F.	382 F.	608 F.	377 F.	590 F.
Draft (stack base) (in.) (av.)	.34 in.	.34 in.	.31 in.	.28 in.	....	....
Temp. flue gas (stack base) (av.)	527 F.	385 F.	456 F.	362 F.	....	444 F.
Temp. feed water (av.)	233 F.	230 F.	222 F.	224 F.	....	207 F.
Temp. hot well (av.)	118 F.	112 F.	117 F.	119 F.	....	120 F.
Temp. L. P. Rec. (av.)	229 F.	233 F.	....	244 F.	....	....
Fuel	Anth. Coal	Anth. Coal	Anth. Coal	Anth. Coal	Anth. Coal	Anth. Coal
Fuel, B. T. U. per lb	12,758	11,166	12,483	12,423	....	....
Fuel, per hr. lb	1,450	1,520	2,024	1,968	1,428	1,205
Fuel, per hr. per sq. ft. grate	16.15	16.85	18.6	18.1	16.5	13.9
Fuel, per I. H. P. hr	2.29	1.90	2.61	2.218	....	....
Fuel economy, percent	....	17%	....	15%	....	15⅝%
Indicated thrust	17,650	21,300	20,272	22,900	....	....
Hull dimensions	136 x 26 x 13-4		140 x 29 x 16-5		140 x 27 x16	
Hull, gross tons	446		452		398	
Engine, type	Triple Expansion		Triple Expansion		Triple Expansion	
Engine, dia.-cyls	16 9/16" x 25¼" x 43¼"		17½" x 25" x 43"		17" x 25" x 43"	
Engine stroke	30"		30"		30"	
Boiler—Type	S.E. Scotch		S.E. Scotch		S.E. Scotch	
Boiler, number	One		One		One	
Boiler, pressure, allowed	180 lb. sq. in.		190 lb. sq. in.		180 lb. sq. in.	
Boiler, number furnaces	Four		Four		Four	
Boiler, grate area (total)	90 sq. ft.		108.5 sq. ft.		86.6 sq. ft.	
Boiler, total evap. surface	3,066 sq. ft.		3,228 sq. ft.		2,926 sq. ft.	
Boiler, draft	Natural		Natural		Natural	
Propeller, number blades	Four		Four		Four	
Propeller, diameter	10' 0"		10' 6"		10' 0"	
Propeller, pitch	13' 6"		13' 6"		13' 6"	

*Light vessel. no tow

High Degree Superheat Successful

The degree of superheat obtained can be governed by a mixing pipe, which keeps the superheated steam at any desired temperature by admitting the proper amount of saturated steam to the main steam pipe. The average steam temperature obtained with this superheater is about 565 degrees, which, with a steam pressure of 180 pounds, is equivalent to 185 degrees of superheat. A maximum steam temperature of 620 degrees, corresponding to 240 degrees of superheat, has been successfully maintained.

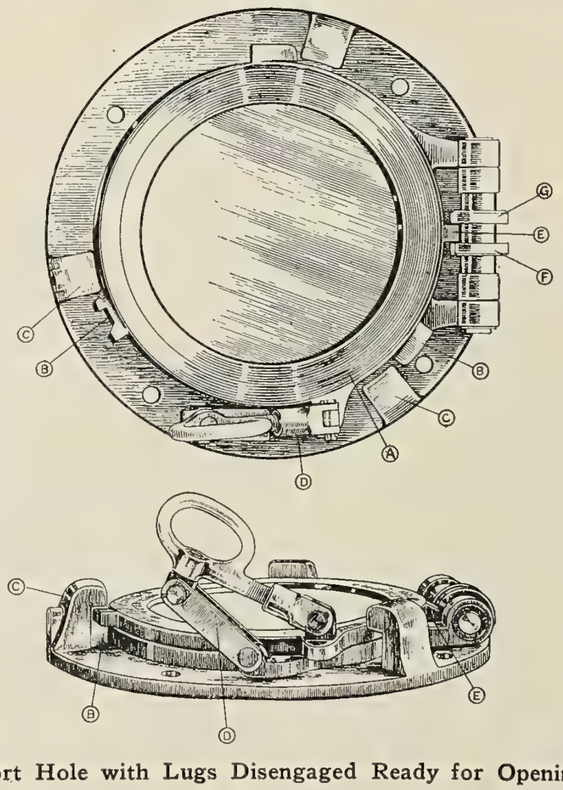
High degree superheat and fire tube superheaters have been employed extensively in European marine service for many years. It is interesting to note that the first American shipowner to equip a vessel with fire tube superheaters was an American railroad on which high temperature superheat and superheaters had come to be regarded as essential to efficient, economical locomotive operation.

Automatic Locking Safety Port Hole

THE "Smithson" safety air ports with which the *Olympic* is equipped are now being manufactured in the United States by the Mercantile Specialties Company, 11 Broadway, New York. Rapidity of closing is a special advantage claimed for the port and this is accomplished without the use of a spanner or key. The port is provided with an automatic lock which is arranged so that the port can be left under the control of the passenger when desirable or locked by simply removing a special key.

The mechanism of the port consists of a rotating ring *A* by means of which the port is fastened. This ring carries a series of wedge blocks *B* which engage under lugs *C* on the base frame, when the port is closed. The pressure of the ring on its rubber seat is uniform and eliminates the possibility of cracked glass and strains on the porthole frame. The ring is rotated by means of toggle *D*.

In opening the port, a toggle handle is raised until the ring has rotated sufficiently to allow the stop *E* to pass through the slot in collar *F* and bring up against the collar *G* which prevents further movement and allows the port to open. To close the port, the handle is simply moved down,



Port Hole with Lugs Disengaged Ready for Opening

when the stop *E* passes through the slot in collar *F*, allowing the rotating ring to move and engage the wedge blocks under the lugs.

In England the device has been approved by the Board of Trade for all classes of ships.

Canvas, Bunting and Felt for Shipbuilding Purposes

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

THE canvas of principal value for shipbuilding purposes is cotton duck and the heavier weights of cotton duck are always sold by number, hence the material is known to the trade as Number Canvas.

Number Canvas

It is customary to call for cotton duck when specifying canvas for sails and frequently some well known and thoroughly tried out brand is designated, but it is not so well understood that practically all of the canvas used about a ship should be of this material, including deck coverings and the less important covers for items of equipment exposed to the weather.

The nature of Number Canvas and the usual requirements which govern the production of this material are embodied in the Navy Department detail specifications for cotton canvas, and can probably be best and most concisely stated by the following excerpts from these specifications. The warp threads run lengthwise of the piece and the filling threads run at right angles to the warp threads.

Quality.—The canvas shall be made of cotton of a grade not inferior to middling cotton thoroughly cleaned, with yarn evenly spun. The thread shall be twisted multiple ply, the number of ply to depend upon the weight and number of the canvas. The fabric shall be properly woven and as free from lumps, knots and imperfections of manufacture as the best commercial grades of canvas.

Width and Length.—The canvas shall be uniformly woven with even and straight selvages to the full width specified, an excess width of ¼ inch being allowed. The width of any bolt shall be uniform throughout its entire length. Two-thirds of any delivery shall have a length of at least 90 yards per bolt. Shorter lengths, ranging from 45 yards up, will be acceptable, but not more than one-third of any delivery shall consist of short-length bolts.

Tests.—The strength of the material shall be determined as follows: (a) Test pieces will be prepared by cutting samples 8 inches long by 1¼ inches wide and then pulling out threads from both sides of the narrow section of warp test pieces until three threads remain on each side of a standard width of 1 inch. All filling test pieces will have threads pulled out until a standard width of 1 inch is reached.

(b) Five test pieces from the warp and a like number from the filling taken within the selvage will be dried for one hour at a temperature of 150 degrees F.

(c) The test pieces immediately upon removal from the drying oven will be placed in the jaws of a testing machine with jaws 3 inches apart and pulled to rupture at a rate of 20 inches per minute.

Strength, Etc.—(a) The strength of no one of the five test pieces cut from either the warp or the filling of the same bolt shall be less than the average strength of the five by a greater amount than 10 percent of that average.

(b) The strength and other physical characteristics of the material shall be as follows.

A table follows which gives the standard weights of the canvas per linear yard under normal atmospheric conditions, from which a variation of 2 percent calculated from the weight of an entire bolt is permitted, gives distances of the customary blue warp thread from the edge, ranging from 1 inch on the No. 10 canvas to 1¾ inches on the No. 1 canvas, and gives the minimum strengths allowable. These strengths, in pounds, are:

	Warp	Filling
No. 1	160	200
No. 2	150	190
No. 3	145	180
No. 4	140	170
No. 5	135	150
No. 6	125	140
No. 7	120	115
No. 8	105	105
No. 9	100	105
No. 10	95	95

Number Canvas is made hard, medium and soft in all numbers to 6 inclusive and all lighter canvas is hard. The hard is the tightest weave, most waterproof and best for deck covering and covers generally. The medium is best for sails as it is not so stiff and difficult to handle when wet. The soft is not needed for shipbuilding purposes.

The numbers range from 12/0, which is extremely thick and heavy, to 1/0 or 0, and thence on down to No. 12, which is the lightest and has a two thread warp and a two thread filling. The numbers most met with in shipbuilding are 0 to 6, although large sails are sometimes made as heavy as 2/0. No. 0 is about .055 inch thick and one yard 22 inches wide weighs 19 ounces. No. 6 is about .043 inch thick and one yard 22 inches wide weighs 13 ounces. It will be noted from this that in the 22-inch width the weight varies one ounce with each number. In order to compare the weight of Number Canvas with that of any canvas which is sold by weight it is only necessary to divide the even ounces of the Number Canvas which apply to the 22-inch width by 22 and to multiply by the width in inches which forms the basis for the ounces, or the weight per yard, of the other canvas. The table given below, which shows the weights of Number Canvas for the standard widths of Army Duck and Ounce Canvas, will be found of convenience in this connection.

Weight Per Linear Yard in Ounces

Width in Inches—	22	28.5	29
No. 0	19		
No. 1	18		
No. 2	17		
No. 3	16		
No. 4	15		
No. 5	14		
No. 6	13		
No. 7	12	15.5	15.8
No. 8	11	14.2	14.5
No. 9	10	13.0	13.2
No. 10	9	11.7	11.9
No. 11	8	10.4	10.5
No. 12	7	9.1	9.2

Standard widths for sail duck are 22 inches to conform to the practice in this country and 24 inches to conform to the practice in England. These widths are often used for deck covering and in other places where narrow strips are desirable. Number Canvas from numbers 1 to 12 can be obtained in widths from 6 inches to 144 inches.

*Member of the firm of Rossell & Thayer, Naval Architects and Marine Engineers, Philadelphia, Pa.

Army Duck

Army Duck is of the same weave as Number Canvas, both the warp and the filling threads being twisted. These threads are lighter than those of the Number Canvas and the material is therefore of a tighter weave and even more waterproof than the Number Canvas. It was designed particularly for the making of tents.

Army Duck is graded by weight, which tends to confuse it with Ounce Canvas. The standard width is 28½ inches and the weights per linear yard at that width are 7, 8, 9, 10, 12 and 15 ounces. It can also be obtained in a 37-inch width weighing 10.38 ounces per linear yard and in a 40-inch width weighing 11 ounces, and greater widths are made to order.

The writer understands that the Navy canvas which they call Ravens is this Army Duck. Ravens is incorporated with duck in the Navy detail specifications for cotton canvas and the requirements for it are identical with those before quoted under the heading of Number Canvas except that the bolts are not required to be over 65 yards in length. The width is 28½ inches and the minimum strengths allowable, in pounds, are:

	Wrap	Filling
8-ounce	80	55
10-ounce	100	65
12-ounce	105	95
15-ounce	125	115

Ounce Canvas

Ounce canvas, which derives its name from the fact that it is graded by weight, is of a different weave from Number Canvas. The warp consists of two threads which lie side by side untwisted, and the filling is either a single or a multiple thread, the latter being twisted. The two kinds go by the names of single filled or double filled canvas, and both unfortunately often also go by the name of duck. The double filled canvas of any weight is of tighter weave and is stronger and more waterproof than the single filled canvas, but it is not the equal in strength or watertightness of true cotton duck.

The weights are based upon a standard width of 29 inches and no other width can be readily obtained. They are 7, 8, 9, 10, 12 and 15 ounces per linear yard, and the single filled canvas can also be obtained in a 6-ounce weight.

The double filled canvas is of value for cushion covers and similar service. The single filled canvas for shipbuilding purposes can be considered only as a cheap substitute for the double filled canvas.

Enameling Duck

Enameling Duck is the trade name for canvas that is made like the double filled Ounce Canvas, of a standard weight of 8 ounces per linear yard 38 inches wide, or two yards to the pound. It can also be obtained in greater widths, all of the same thickness and of correspondingly greater weights. These widths and their weights are as follows:

38-inch	8.	ounces
46½-inch	9.8	"
51½-inch	10.8	"
57-inch	12.	"
61-inch	12.8	"
72-inch	15.2	"

This canvas is of value for pipe and boiler coverings, the 38-inch width being used mainly for the former and the greater widths for the latter.

A single filled canvas of this nature may be obtained but as with the regular run of Ounce Canvas it is only a cheap substitute for the double filled canvas.

Hose Duck

Hose Duck is of the same construction as Number Canvas, with twisted warp and filling threads, but it is of a looser weave and softer. It comes in a standard width of 40 inches and in weights of 10, 12, 14, 16, 18, 20 and 22 ounces per linear yard. It can be obtained in greater widths to order.

As its name implies, it is used in the manufacture of hose. It is also of value for pipe coverings.

Other Canvas, Etc.

There are other special types of canvas, but they seldom or never find their way into the shipbuilding field; and there are other cloths which may be substituted in some cases for canvas. One of the latter which it may be of value to refer to is a cloth made of flax, imported from Belgium, which when waterproofed makes an excellent material for the covers and side cloths of deck lighters and similar service, being very durable and pliable as well as of a tight weave.

Waterproofing Canvas

Canvas is waterproofed mainly by concerns who make that their special business and who treat it with some solution which is their particular property. Suitable compounds of this nature can be obtained by shipbuilders and sailmakers who may desire to do their own waterproofing, but the general practice except for small hurry-up jobs is to leave this work to specialists in this line.

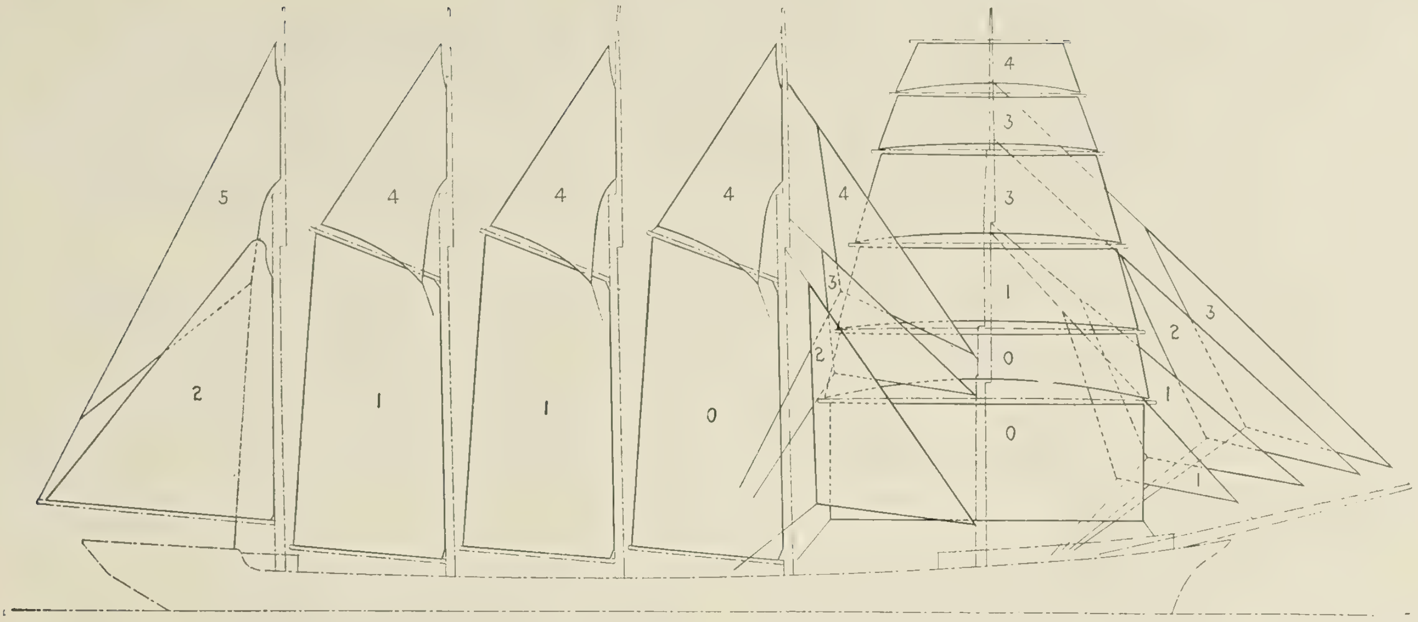
Canvas covers are sometimes specified to be paraffine coated. Although this tends to preserve the canvas it is poor practice from a waterproofing standpoint because it flakes off with the moving about of the covers and with cold and does not stand up under any considerable heat.

Uses for Canvas

Some of the more important uses for canvas on shipboard as well as a suitable weight of canvas for the particular service are listed in the following table. Where a number alone is given it is the number of Number Canvas. The sails of large sailing vessels as listed are those of the barkentine illustrated by the accompanying plan, and their locations may be readily determined by reference to the corresponding numbers of canvas on this plan. These weights will form a fair guide for the weights of sails in similar locations generally.

List of Sails for a Barkentine

	Number or Weight of Canvas
Sails of Large Sailing Vessels	
Fore staysail	1
Fore topmast staysail	1
Inner jib	2
Outer jib	3
Fore sail	0
Lower top sail	0
Upper top sail	1
Top gallant sails (2)	3
Royal	4
Main staysail	2
Middle staysail	3
Main topmast staysail	4
Main sail	0
Mizzen sail	1
Jigger sail	1
Spanker	2
Gaff topsails	4
Ringtail topsail	5
Sails of Schooner Barges	2
Sails of Steamships	3
Sails of Small Vessels	4 to 12, according to size
Lifeboat Sails	11
Tarpaulins	
Weather deck hatches	2
Tween deck hatches	4
Lighter covers and side cloths	2



Sail Plan of Barkentine

Awnings, Etc.	
Awnings generally	3
Pilot house visors	4
Weather cloths	4
Dodgers	6
Crows nest	6
Deck Canvas	
Decks generally	2
Top of pilot house and similar locations where there is no traffic	4
Weather Covers	
Bells	8
Binnacles	6
Boat fall gear	6
Capstans	4
Engine telegraphs	6
Gun covers	4
Hawser reels	6
Lifeboats, single	5
Lifeboat nests	4
Mast coats	2
Sail covers	
Large sails	5
Small sails	8 to 12
Searchlights	
Large installations	4
Small installations	6
Skylights	2
Sounding machines	6
Steering gears	4
Steering wheels	6
Ventilator cowls	6
Ventilator plugs	6
Winch covers	4
Windlass covers	3
Work boats	6
Underdeck Covers	
Electrical machinery	12-ounce Army Duck
Switchboard	8-ounce Army Duck
Miscellaneous portable covers	12-ounce Double Filled
Miscellaneous	
Bags	4
Cots	7
Hammocks	1
Pipe and boiler covering	8-ounce (for 38-inch width) Enamelling Duck
Sea anchors	6 or heavier
Swimming tanks	0
Upholstery	8-ounce Double Filled
Wind sails	4
Wood watertight bulkheads	6

Wool Bunting

The only bunting of real value in the marine field is Wool Bunting and its nature and the requirements that it should live up to may be best stated by quoting from the Navy Department detail specifications for this material.

Quality.—Wool bunting shall be made entirely of the best quality of wool, well woven, finished, of good workmanship, and free from all defects and blemishes which may affect the appearance or serviceability of the fabric.

Construction.—The yarns shall be well and evenly spun; both warp and filling shall each contain not less than 34 threads to the inch; the warp shall be two-ply and the filling one-ply, properly twisted.

Width and Weight.—The bunting shall be fully 18 inches in width. The weight shall be not less than 5¼ pounds avoirdupois per piece or bolt of 40 yards.

Strength.—The average strength of the material shall be not less than 25 pounds per inch of width of warp and not less than 18 pounds per inch of width of filling, based on test pieces prepared and tested as follows:

(a) The test pieces will be prepared by cutting samples 8 inches long by 1¼ inches wide and then pulling out threads from both sides of the narrow section until the standard width of 1 inch is reached.

(b) Ten test pieces, 5 from the warp and 5 from the filling taken from various parts of the fabric within the selvage, will be dried for 1 hour at a temperature of 150 degrees F.

(c) Immediately upon removal from the drying oven, the test pieces will be placed in the jaws of a testing machine with jaws 3 inches apart, and pulled to rupture at the rate of 20 inches per minute.

Comparison with Standard Sample.—Deliveries shall be equal or superior in quality, finish and all other respects to the standard samples, portions of which may be obtained from the navy yard at which delivery is to be made; color shades of deliveries shall conform to the standard sample of bunting on hand at the navy yard, New York, and tests of colors as outlined in paragraph 7 below shall be made upon samples taken from deliveries and from standard samples on hand at the navy yard, New York.

Tests of Colors.—Colors shall be fast and stable when exposed to light or the action of fresh or salt water. When samples taken from deliveries and from the standard sample on hand at the navy yard, New York, are subjected to the same tests, the results of the tests upon the delivery shall be at least equal to the results obtained upon the standard sample in immersion in fresh water, salt water, exposed to the rays of a quartz-burner mercury-vapor lamp, and exposure to the weather for 10 days, of which not less than 30 hours shall be bright sunlight.

Packing.—Each bolt of bunting shall contain at least 40 yards of bunting, shall be neatly and evenly rolled upon a wooden roller, and wrapped in paper. The wrapping shall be closed at each end by a paper label of the color of the bunting, and shall be plainly marked with the quantity in the bolt.

The only important use for wool bunting is in the making of flags of all kinds. It is sometimes used for decorative purposes.

Cotton Bunting

Cotton Bunting is a poor material and the colors are not fast.

The fact that the Navy Department has prepared detail specifications for Cotton Bunting along the lines of their specifications for Wool Bunting might lead to the conclusion that the former can be used for flags with satisfactory results. This is, however, not the case. The specifications were prepared in 1917 as a war emergency measure on account of the difficulty in obtaining Wool Bunting in sufficient quantities.

Sheathing Felt

The sheathing felt used for various purposes about a vessel, as a backing for wood or metal sheathing on a wood hull, or for canvas on joiner decks, between the layers of double wood bulkheads, as a calking material, etc., is a product which is imported from Ireland. It is made of flax or jute, cow hair and pine tar. It comes in sheets about 1/16-inch thick and 32 inches by 36 inches and 32 inches by 40 inches in size, which are packed in crates containing 250 sheets each.

The Navy Department detail specifications for tarred sheathing felt state that it shall be made from jute or flax saturated with approved resinous or tarry material, that it shall be delivered in sheets about 32 by 40 inches, and that it shall weigh not less than 2 nor more than 3 ounces per square foot.

Imitations of this felt are produced by one or more of the paper mills in this country, but such of this product as has come to the attention of the writer is very inferior and undesirable for shipbuilding purposes.

A Few Suggestions

Specify Number Canvas, or its equivalent in the lighter weights, for all service where strength and waterproof qualities are important.

Use a well tried make or have the material tested.

In dealing with canvas that is named by weight be sure of the width to which the stated weight has reference.

Use narrow widths, 14 inches to 20 inches, for sails of yachts and other small vessels as these are easier to handle and will lie better.

Canvas should be waterproofed when it is to be used for the top tarpaulin on weather deck cargo hatches. These hatches should preferably have three tarpaulins on them, all of the same weight.

Waterproofed canvas should be used for deck cargo covers.

Canvas swimming tanks should be double, the outer canvas being waterproofed. The inner canvas should also be waterproofed were it not for the oily nature of the coating used.

Canvas for dynamo covers should be waterproofed.

Canvas covers are usually not required for deck machinery such as the windlass, winches and capstans.

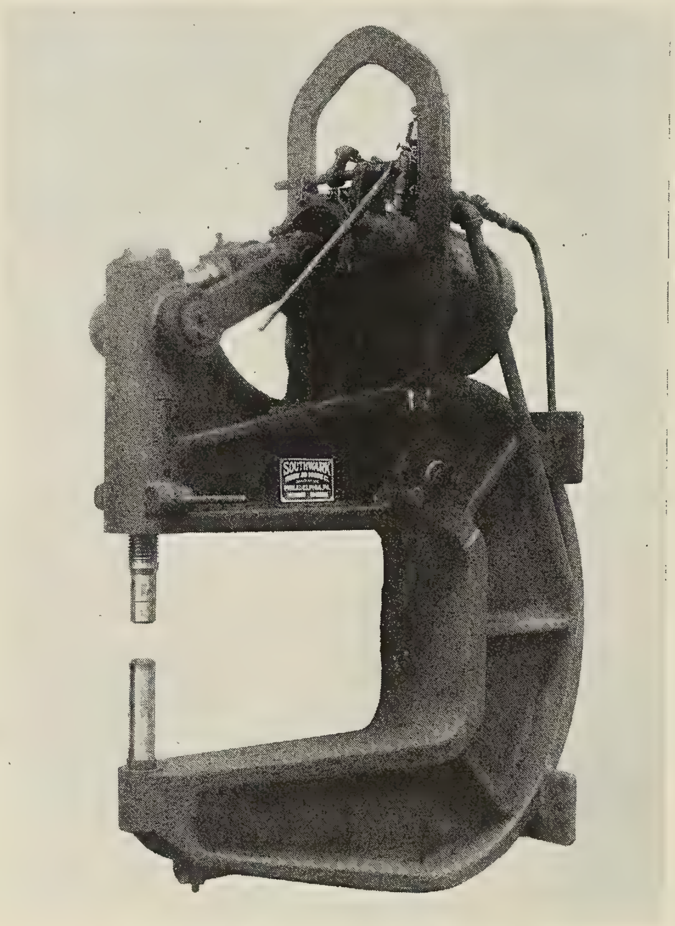
The old practice of laying felt on joiner decks underneath the canvas is not a good practice and involves unnecessary expense. Owners and shipbuilders are coming more and more to a realization of this. The argument in favor of the felt is that the tongue and groove construction of the decking causes the boards to stand up at the edges, thereby bringing about the rapid wear of the canvas along these joints when felt is not used and also making an uneven appearance. This difficulty can be overcome where necessary by going over the edges with a plane.

The objections to the felt are the cost and weight of the felt and the fact that when felt is used the canvas is more apt to be torn by boards or other heavy objects dropped on it. The felt is also said by some to rot the canvas.

Where the wood decking is given a thick coat of white lead and linseed oil paint and the canvas is laid while this is wet, and immediately given a heavy coat of linseed oil, and then two or three coats of white lead paint, according to the location, the results will be as good as, if not better than, with felt between the canvas and the wood.

Driving Rivets With Toggle Type Pneumatic Riveters

FOR portable service pneumatic toggle type compression riveters have been found well adapted, while hydraulic riveters are generally used in stationary work where machines of deep reach are needed. The following explanation is given of the action of the toggle arrangements on pneumatic compression yoke riveters built by the Southwark Foundry and Machine Company, Philadelphia, Pa., which specially adapts them to portable service. Riveters are made by this company in sizes from 15 tons up to those developing 150 tons on the die and having a reach of 23 feet.



Pneumatic Toggle Type Riveter

The toggle mechanism is designed to act rapidly until the die reaches the point of the rivet when it gradually decreases in speed and at the same time increases the pressure exerted on the rivet. The die travel is practically uniform towards the last of the operation and thus ensures driving tight rivets, drawing the plates together and following up the shrinkage of the rivet with full pressure until it is set. The die should be adjusted for any run of work.

All portable machines are provided with means for suspension and those above 36-inch reach with feet for mounting when used in stationary service.

The Most Interesting Job in the Yard

In comparing one job with another in a shipyard there is always some feature of special interest not only to the man who holds the job but also to the other workers in the yard. In recent issues we have published the views of machinists, engineers and engine builders. This month a draftsman tells why he considers his job the most interesting one in the yard. How does your job compare with these? Tell us about it.

NULLI SECUNDUS has chosen a doubtful nom-de-plume, at least I consider that the interest factor in his job is a long way second to that in mine. I am a draftsman. That statement in itself is almost enough without elaboration but the justification for my claim must be set down, so I propose to take one order I received from my chief to prove it.

I was working in a large naval establishment when the order came to "get out the torpedo arrangements." I had my complete order in those few words, but what a vista of interest it unveiled!

First I had to consider the general arrangement. There never had been a ship with eighteen torpedo tubes before. The tubes were new, the torpedo was new, the general idea was new and the whole job was fresh. I had to arrange the position of the tubes, how to get them into the ship, how to secure them and how to protect them from gunfire. Then to get the torpedoes on board from a wharf or from the water, to devise ways and means to transport them along the deck, strike them down to the 'tween deck space, to transport them there to stowage positions, to each and every tube, to workshops and assembly room and to turn them end for end in a limited space. Then came the arrangement of magazines to stow the war heads and dummies, to arrange workshops with benches and machines, to work out details of stowage brackets, transporting trolley, special hatchways, pulleys, derricks and winches and a host of accessories.

Just take one item as a sample of interesting work—the idea for protecting the tubes from gunfire. Large armored doors had to be arranged to hinge outboard and to be geared to work from inside. Each door weighed about 2½ tons and there were two at each set of tubes. The gearing had to be strong enough to open the doors against a list of several degrees and yet work easily so that one or two men could operate them. I saw that if a wave hit the forward door it might destroy the gearing so I had to devise a friction clutch between the hinge and the gear which would hold enough to open and close the door and stand a sufficient pressure to insure that the doors were reasonably watertight when they were shut but which would slip if a blow were applied before the worm of the gear would strip.

Here was interest indeed! I had to resuscitate my knowledge of worm gears and ball bearings, to polish up my calculus and the theory of the screw with friction and to sharpen my wits as well as my pencil. By the time the design was finished there was little of interest left to spare for Nulli Secundus. His work was reduced to reading the drawing. (You can see those doors and friction clutches in the lower left hand corner of Fig. 19, page 214, of your March, 1921, number, Mr. Editor.)

Then again there was the transporting job. To get a ton and three-quarters of torpedo down a hatchway, not more than three-fifths of the length of the torpedo long, into a 'tween deck space only seven feet six high required a nicety of placement of tackles hard to equal. Then to work out the tracks so that the long body could be moved from end to end of the ship and turned about and switched to each tube and stowage point was another phase. This involved considerable scheming and the design of a lifting block which would work in a headroom 6 inches less than had previously been designed for and that at an increase of lifting power.

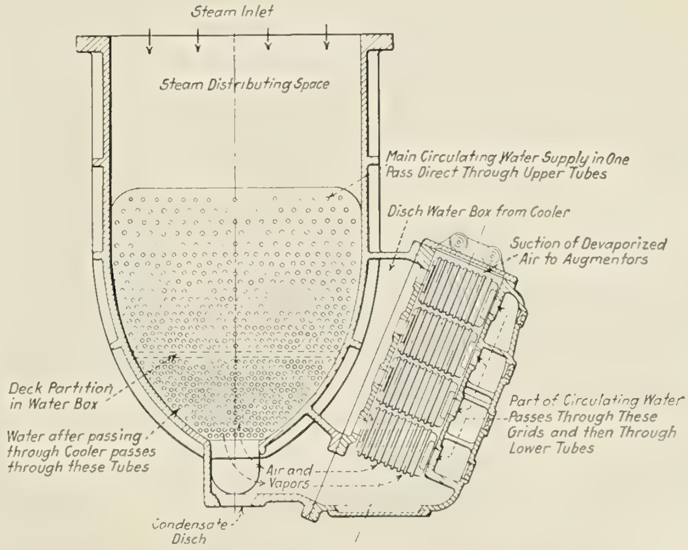
That one order led me to prepare 26 arrangement and detail drawings in the course of 12 months and I can say that there was not a melancholy moment in the whole time. Considering that a large vessel bristles, from keel to truck, with such tantalizing problems, can it be wondered that I claim for the draftsman the premier place as the holder of the most interesting job in the shipyard?

Pulman qui meruit ferat.

New Brighton, N. Y. I. C. G. Cooper.

Waste Tubes Eliminated in New Surface Condenser

SURFACE condenser troubles are in general of two kinds—corrosion, causing tube leakage, and the accumulation of slime and scale fouling the tube walls, both due to unsuitable boiler feed water. To overcome these difficulties, the Ingersoll-Rand Company, New York, has developed an improved type of condenser in which waste tubes are eliminated, a uniformly high condensate temperature is maintained, counter-current air cooling provided and corrosion and fouling reduced to a minimum.



Cross Section Through Main Condenser and Cooler

Waste tube elimination is secured by arranging the tubes in "stages," by correct shell shape and by the use of a separate devaporizer-cooler. The tubes spaced on wide centers in the top of the shell are brought closer together in each lower bank or stage. The shell itself is gradually narrowed from the widest point at the top to that of a nozzle running the length of the shell under the last row of tubes. This construction gives a sufficiently high steam velocity to sweep condensate and air films from the tubes, which action compensates for the decreased volume of the steam as it is condensed in its passage down over the tubes. The residual air and steam from the last row of tubes is drawn up into the cooler which is mounted on the side of the shell proper and fitted with cast iron cooling grids whose

surfaces are adapted to devaporize and cool the air before it passes to the vacuum pump.

The devaporizing and cooling of the air is carried on independently in the cooler through which the flow is upward to the vacuum pump or steam jets. It is thus possible to cool the air without a corresponding lowering of the condensate temperature.

A single-pass arrangement in the I-R condenser makes possible high water velocities without excessive friction. The tubes are kept clear of slime and scale by this means which tends to reduce the temperature at the inner tube walls.

LETTERS TO THE EDITOR

Wear of the Teeth of Marine Turbine Reduction Gears

The wear of the teeth of marine turbine reduction gears is not being eradicated with material success, and it is unfortunate that such important parts of the propelling machinery of steamships should require exquisite workmanship and fitting and so much attention to oil and oiling. These features are especially out of place on such a coarse and flexible structure as a ship.

While no part of a marine turbine can stand inaccurate fitting and alinement such as are somewhat possible with reciprocating engines, designers are getting themselves more deeply into difficulty and there will be no outlet, if refinement is the attempted remedy. Any mechanism should have means of rendering slight inaccuracies harmless, but that principle cannot be applied to present designs of reduction gears.

The precision required in the case of double, and but slightly less with single reduction gears, should by some change become unnecessary. Considering the single turbine double reduction gear, the small pinion lies between two large gears and the teeth must fit them both exactly. That presents great difficulty, because the pinion and gears are each made in two parts with helical teeth inclined in opposite directions. These teeth must be located with the utmost nicety, and here more undesirable precision is required.

Still further, the two gear shafts each have a double pinion with oppositely inclined helical teeth, and the secondary gear must fit these two pinions. If one half pinion tries to accommodate itself to its gear, it tries to pull all other gears out of place. The whole assemblage is locked and there is no opportunity for accommodation to distortion or temperature changes.

Moreover, the longitudinal immovability of the system violates an important requirement for good distribution of lubricant and uniform wear. When Professor Sweet designed the Straight Line Engine he made the crank pin and shaft bearings longer than the boxes in order to permit free longitudinal movement of the shaft so that it could distribute the oil and wear uniformly. This is also done on direct current electric machines in order to wear commutators uniformly, and unless it is done with turbine gears there will never be any certainty of success, especially with double reduction gears. In the second reduction the halves of each pinion are some distance apart with a bearing between and, if the bearing heats and expands, the pressure on the teeth due to wedging action must be tremendous. This pressure not only occurs at this point but is transmitted to the primary pinion and the latter must encounter almost impossible service. These troubles have been somewhat reduced by having the secondary pinions on sleeves driven by interior shafts clutched to them at the aft ends. This is a step toward the accommodation for which I am pleading.

The requirements here pointed out, of course, can be met only by the use of teeth parallel to the axes of the shafts, and I venture to predict complete success with such gears on the first trial, especially if end play of shafts is allowed, and that they will ultimately be used. Pinions can be single and the necessity for intermediate pinion and gear bearings disappears, as well as sleeve shafts and clutches.

When De Laval turbines first appeared they had gears with helical teeth, and nobody has ventured to abandon them. Designers appear to assume that such gears are necessary, but as long as they are used there will be trouble.

Another cause of difficulty comes from using steel on steel. If anything is well established it is that steel on steel is a bad rubbing combination. Steel is selected on account of its strength, but cast iron would be much better, and, except the pinions, could probably be made of sufficient strength. Cast iron is the best of all rubbing materials because it has small cavities which hold oil. Steel rubbing on cast iron does well, and it would probably work well to have steel pinions working on flanged cast iron toothed rings bolted to the gear centers. Strong air furnace castings should be used.

Boston, Mass. F. W. Dean.

Should Direct or Alternating Current Be Used for the Lighting Set?

The almost universal use of direct current for lighting purposes on board ship is no more conclusive evidence of its superiority to alternating current than the fact that we now walk, whereas in a few decades we shall probably fly with equal ease, is an argument that walking is the better method.

Leaving out the main advantage of alternating current, the ease of transmission and distribution, because on a ship this is not paramount although very real on a large boat, and without enumerating the special advantages of alternating current apparatus and the simple alternating induction motor, it cannot be gainsaid that this same alternating current motor is the most widely used piece of apparatus in the world today. This would be no argument, if there were any other equal method put forth, but there is no direct current motor that has equaled its ruggedness, simplicity and general usefulness. It has no flash-over troubles, no commutator to take care of, and when voltage is applied it is bound to go; it can be reversed easily and definitely; speed changes can be made by using field combinations and the more improved types of induction motor will give all the speed regulation necessary for any service.

Witness the recent use of this motor in crane service, where the direct current motor was thought impregnable. Bells, signals, enunciators, lights, motors and accessories can be operated more efficiently from alternating current than from direct current, and such apparatus as requires storage batteries, such as telephones, telemotors and exciters for the alternating current regulators, can be supplied from a storage battery which is necessary on board a ship whether alternating current or direct current is the power supplied.

Alternating current wiring is just as simple as direct current wiring at the same voltage and the underwriters, or Lloyds, or the American Bureau of Shipping make no difference in the wiring requirements, except that direct current switching apparatus, because of the great danger of flash-over at heavy current and low voltage, has to be especially safeguarded whereas the flash-over from an alternating current circuit, which is non-inductive as is a lighting circuit, is practically nil. This latter feature of no flash-over is probably a safety feature of a thousand times more magnitude than the fact that direct current on the same voltage does not give as great a tingle or shock to the operator as alternating current.

Alternating current has been the ultimate winner in every field in which it has competed and I am very glad to see the subject raised in shipbuilding circles.

Newark, N. J. Young American.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Size of Piston Ring—Arrangement of Buckets on Side Wheels—Lining Up a Beam Engine

Q. (1142).—(1) How much larger should a piston ring be than the steam cylinder to which it is to be cut and fitted? How much should be cut out of the eccentric turned rings, and give the thickness of the thinnest and thickest places? While I have in mind a steam cylinder of 6⅛ inches bore, I am anxious for a rule or formula that can be used for other rings.

(2) With a beam engine driving two side wheels, what effect will the loss of a few buckets have on the speed of the vessel, the steam pressure and throttle opening remaining the same as before? Should the same bucket area be put on all arms, or will there be anything gained in speed and fuel, if more buckets are added on the wheels, that they may be in the water when the maximum pressure is on the shaft? Explain how I may better balance my engine and save fuel, making same speed.

(3) How would you line up a beam engine?

A. (1142).—(1) The following quoted from "Mechanical Engineers' Pocket Book," Kent, edition 1916, pages 1023 and 1024, is believed to cover your question:

"Diameter of Piston Packing-rings.—These are generally turned, before they are cut, about ¼ inch diameter larger than the cylinder, for cylinders up to 20 inches diameter, and then enough is cut out of the rings to spring them to the diameter of the cylinder. For larger cylinders the rings are turned proportionately larger. Seaton recommends an excess of 1 percent of the diameter of the cylinder.

"A theoretical paper on Piston Packing Rings of Modern Steam Engines by O. C. Reymann will be found in the Journal of the Franklin Institute, August, 1897.

"Cross-section of the Rings.—The thickness is commonly made 1/30 of the diameter of cylinder + ⅛ inch, and the width = thickness + ⅛ inch. For an eccentric ring the mean thickness may be the same as for a ring of uniform thickness, and the minimum thickness = ⅔ the maximum.

"A circular issued by J. H. Dunbar, manufacturer of packing-rings, Youngstown, Ohio, says: 'Unless otherwise ordered, the thickness of rings will be made equal to 0.03 × their diameter. This thickness has been found to be satisfactory in practice. It admits of the ring being made about 3/16 inch to the foot larger than the cylinder, and has, when new, a tension of about two pounds per inch of circumference, which is ample to prevent leakage, if the surface of the ring and cylinder are smooth.'

"As regards the width of rings, authorities 'scatter' from very narrow to very wide, the latter being fully ten times the former. For instance, Unwin gives $W = 0.014\ d + 0.08$. Whitham's formula is $W = 0.15\ d$. In both formulæ W is the width of the ring in inches, and d the diameter of the cylinder in inches. Unwin's formula makes the width of a 20-inch ring $W = 20 \times 0.014 + 0.08 = 0.36$ inch, while Whitham's is $20 \times 0.15 = 3$ inches for the same diameter of ring. There is much less difference in the practice of engine-builders in this respect, but there is still room for a standard width of ring. It is believed that for cylinders over 16 inches diameter ¾ inch is a popular and practical width, and ½ inch for cylinders of that size and under."

(2) It is assumed that the paddle wheels were suitably designed so as to deliver the required thrust at the designed number of revolutions, also that at the designed revolutions the engines were developing the designed full power.

If the loss of buckets were evenly distributed around the entire circumference of the wheel, the effect would be similar to that resulting from too small an immersion of the wheel or from fitting buckets of insufficient area. The thrust delivered by the wheel would tend to decrease, the revolutions to increase above the designed and the slip to become excessive. The speed of the vessel would fall off.

If, as seems more natural, several consecutive buckets were lost the thrust would tend to decrease and the speed of rotation increase over the designed when this portion of the wheel was in the water and during the remainder of the revolution the thrust would tend to increase and the speed to decrease approaching the designed figure. Such changes in thrust and speed of paddle wheel would result in serious variation in engine revolutions which would develop heavy periodic stresses in the reciprocating parts and engine frame. The speed of the vessel would fall off as in the previous case.

It is practice to make all buckets on a paddle wheel of one size and type. The fly wheel action of the heavy paddle wheel aids in reducing the peripheral variation in speed. However, unless multiple cylinders are installed, it is impossible to avoid wide variation in crank effort. When all buckets are of the same size, excess torque produces increased slip (the individual bucket being designed for average torque). Were bucket areas proportioned to torque, the thrust against the water would also be proportional to torque and the vessel would be subjected to a marked impulse every revolution of the wheel similar to that produced upon a row boat by the stroke of an oar. Such an arrangement would involve undue strains upon machinery and foundations, would be uncomfortable for passengers and would probably be wasteful of power due to the alternate acceleration and retardation of the ship.

Assuming proper design, as originally stated, the care and adjustment enjoined by good engineering practice is all that could be suggested on the basis of the information furnished. Material improvement in balance is probably a matter of considerable expense, if possible at all.

(3) The methods described in the writer's reply to Q. 1124, July, 1921, page 563, should be of assistance in lining up your engine.

Density of Boiler Feed Water—Point of Cut-Off—Numbers on Engineers' Licenses

Q. (1143).—(1) If sea water is taken as containing 5 ounces solid matter per gallon, or 1/32 of its total weight, what is the working or usual upper limit allowed for working a Scotch boiler for density? For a Babcock & Wilcox boiler?

(2) When it is stated that the cut-off of a cylinder is 0.625, does this mean that the piston has traveled 0.625 of its total stroke when cut-off occurs, or does it mean that 0.625 of the stroke has yet to be completed?

(3) In the upper corner of an engineer's license there are numbers written in, such as 1-1 or 3-4. What do each of these numbers refer to?

A. (1143).—(1) For good operation of Scotch boilers when salt water is used for make up feed, the saline density should be maintained between 1/32 and 2/32, the 1/32 preferred if possible. Sea water contains magnesium chloride which, when heated, decomposes, liberating hydrochloric acid,

which causes rapid corrosion of iron and steel. It has been found by experiment that, when the brine salinity is allowed to go above 4/32, large quantities of the acid are given off and cause corrosion in a very short time. In addition to the hydrochloric acid danger, there is in sea water a considerable amount of air and some carbonic acid gas. These also cause serious corrosion; this cannot be prevented, but is obviated to some extent by placing an air chamber at the main feed heater outlet, to serve as a collector and air and gas split off. Furthermore, when the boiler and fittings are made, some parts of iron or steel and others of composition, corrosion takes place from electrolysis (battery action, decomposing the steel or iron). Zinc protectors are usually placed within the boiler to counteract this trouble. With reference to watertube boilers, as a rule, when sea water is being unavoidably admitted to the boiler, blowing down should not be resorted to until the saturation exceeds 600 grains of chlorine per gallon in Babcock and Wilcox or fire tube boilers, 300 grains in Niclausse boilers, and 150 grains in small bent-tube or torpedo boat boilers. (Sea water contains more than one pound of salt for every 32 pounds of sea water, or about 1,850 grains of salt per gallon.)

(2) Cut off is that point in the stroke of a reciprocating engine at which the admission of steam to the cylinder is stopped. Its position in the stroke is expressed as a ratio between the distance already traveled by the piston when cut off takes place and the total travel or stroke of the piston.

(3) Prior to 1900 or 1901 marine engineers' licenses were issued annually. Since that time they have been issued for periods of five years. The first of the figures instanced refers to the number of licenses issued under the old system and the second to those issued under the new. Thus the figures 3-4 would indicate that the engineer had been licensed for a total period of 23 years.

Apertures in Deadwood of Twin Screw Vessels

Q. (1145).—What is the latest practice regarding the fitting of apertures in the deadwood of twin screw vessels, and any alleged advantages or disadvantages of the same?

A. (1145).—Present practice in this country and in England does not favor fitting apertures in the deadwood of twin screw vessels. The tendency seems to be rather toward increased tip clearance (the shortest distance of propeller blade tip from surface of hull).

In a series of eighteen high speed vessels, all of similar type, the first of which was designed about 1908 and the last ten years later, the ratio of tip clearance to propeller diameter increased gradually from about 0.18 to 0.28.

In another series of ten medium speed vessels, the first designed in 1906 and the last in 1919, this ratio increased from 0.15 to 0.20 in the case of ships with large, slow turning wheels and from 0.20 to 0.26 or more for vessels with smaller and faster wheels.

While no apertures were fitted in any of the above cases the deadwood immediately forward of the rudder post was generally cut away below the level of the propeller shafting. This permitted the use of balanced rudders and gave decreased turning circle.

For slow full bodied vessels the same tendency toward increased tip clearance exists but the keel is usually carried aft without break to take the lower rudder pintle.

The following discussions relative both to apertures and to tip clearance are in general agreement with the foregoing and cover the principal advantages and disadvantages involved.

Holms in "Practical Shipbuilding," edition 1918, page 253, writes:

"In a few cases an aperture has been introduced so that propellers may overlap, and thus allow the shaft to be placed nearer the center line. The arrangement is advantageous in that the bossed portion of the vessel's side is less extensive, the length of the propeller brackets is reduced and the strength of all parts is increased; it is not now adopted, however, as it is found to cause excessive vibration."

Taylor in "Speed and Power of Ships," edition 1910, page 243, writes:

"It is undesirable to place screws so that their tips are too close to the surface of the hull. When a screw tip strikes the belt of eddying water adjacent to the hull, the virtual blows resulting are communicated to the ship, shaking rivets loose and causing vibration. The irregular forces upon the propellers also cause vibration of the ship.

"In some twin screw ships this trouble has been partially avoided by having an opening in the deadwood abreast the propellers. This saves the ship and with large propellers of moderate speed of revolution the tips can be brought quite close to one another without giving trouble. For small, quick turning propellers, such as those fitted with turbines, vibrations are very likely to be set up unless the blade tips are kept well clear of the hull, say 30 inches to 36 inches. It seems a pity to lose any of the beneficial action of the wake and it is possible that, if the hull abreast the propeller tip were made of circular shape, with the shaft as a center, specially strengthened to stand the pounding, and the propeller tips fitted close to the hull so that they caught the dead water through a large arc, the beneficial effect of the wake might be had without very objectionable vibration, though such propellers would probably be noisy. That is a matter, however, which could be determined only by a full sized trial. The only solution now known to be successful is to keep the blade tips well clear and accept the slightly reduced efficiency."

NEW BOOKS

Wharf Management—Stevedoring and Storage

Reviewed by C. H. Peabody, Dr. Eng.

Wharf Management—Stevedoring and Storage. By MacElwee and Taylor. Size, 6 inches by 9 inches. Pages, XX + 350. Illustrations, 301. New York: D. Appleton and Company.

This is the first book on the subjects discussed and the authors, who appreciate that the treatment is suggestive and not exhaustive, in it blaze the way for future study of the problems which are numerous and complicated.

Ships, shipping and all things concerning them are conservative; after the Phœnicians and their successors had spent a few thousands of years dealing with the sea they thought they knew something of its moods. The simplicity of the ancient methods of loading ships persists in places to the present day. Under some conditions such methods may be the most efficient, as when a river steamer noses into the levee and the roustabouts swarm ashore and file on board with sacks and bales on their backs. But when we realize that even a fairly active steamer may spend half her time in port and that it may cost as much to handle a package discharged from a ship as to carry it on a sea voyage we begin to understand the importance of this book. Stevedores seldom break out into literature and we can understand why it is necessary at this day to blaze the way. To be explicit, we may note that the expenses of a freighter in port may be $2,000 to $4,000 a day; ships must be loaded and unloaded, and this cannot be unduly hurried; but in a sense a ship is earning money only when at sea.

This work does not deal with the design and layout of wharfs, but at the beginning some ideas are necessary in order to understand the discussion of their management. In America we are accustomed to long narrow wharfs which

sufficed for the days of sailing ships but which now lead to all kinds of congestion and inconvenience. Perhaps the worst condition is found in New York City, which by some fatality has the blocks turned crosswise; the north and south avenues having short blocks and the east and west streets, long blocks. Following this condition and the riparian city rights the wharfs conform to the streets on both North and East rivers, and both wharfs and slips are very inconveniently narrow. Contrast this with the European quays with the ship lying broadside on and discharging from all the hatches to land directly, though the quays also have their own problem in handling cargoes.

Lighterage is found in greatest development in New York City and in some South American ports; for the latter the great difficulty of building wharfs and the comparatively light commerce control conditions; for New York the natural lay of the land on a long narrow island is the dominant feature. There is one advantage in lightering, namely, that freight from any railroad may be delivered to any wharf; when the freight is lightered in railroad cars the conditions are not so bad. The lack, or the impossibility, of a belt line road calls for an excessive amount of trucking; and the trucking may cost a tenth of the worth of certain packages. The antithesis of this condition is found on our Great Lakes in the handling of iron ore, which runs into the ships' holds in streams and is dug out by giant clam-shell buckets.

The administration of the work on the wharf is under the superintendent, with his clerical force and checkers, who must keep proper account of each and every item of freight, and the stevedore with his longshoremen who handle the freight; a good stevedore may be worth too much as such to be promoted to be superintendent, for he is the man who sees that the freight goes in and that it does not shift. Longshoremen are too often recruited from drifting unskilled labor, whereas it takes skill for a man to throw a sack of flour into proper stowage or to induce a barrel to settle in its proper place.

There are two ways of transferring freight to the hold of a ship, (a) through side ports and (b) down hatches. The first is proper for coastwise, Great Lake and river steamers, especially with package freight; the second is almost universal for deep sea ships. The greater part of loading through side ports is by hand trucks, and that goes well enough so long as there is little or no tide so that freight moves horizontally; on the seaboard where there is large rise and fall of tide the labor becomes slow and excessive. A makeshift arrangement is to run by power an endless chain onto which the truckman may hitch and get help uphill. A more completely mechanical method is to have a traveling belt or chain with cross-cleats or pockets into which packages are thrown or placed and which empties them out at the end of the run.

Seagoing ships are habitually loaded through hatches; formerly the hoisting was done by hand power, then a horse was used and lately steam power or electric power. The American system puts the hoisting onto the ships which have masts and cargo booms, usually two booms to a hatch; in consequence wharfs are poorly supplied with hoisting appliances unless in the form of cranes or derricks for specially heavy pieces. Modern winches are rapid and handy, so that one man may work two booms with right and left hand levers. Electric winches are adaptable to motorships; they must be rugged and watertight; they have the advantage of not wasting energy when idle.

A simple but very important matter is the method of hand signaling; this must be simple and positive and should be completely standardized.

A load for a winch is called a draft; it may be a single piece or a bunch; the weight of a draft may be 1,000 or 2,000 pounds. A common method is to wrap a rope sling around a piece or a bunch, slip one loop through the other and catch onto the hook hanging from the boom; or articles may be packed on a platform and all hoisted together.

For heavy pieces of freight a locomotive crane is convenient, running on rails to the place where it is needed. When the volume of such freight is sufficient a gantry crane may run along the face of the wharf. Very heavy pieces like locomotives are conveniently loaded by tower cranes. If cranes are used intermittently the overhead becomes excessive.

The stevedore must have wide experience and a high degree of intelligence to trim the cargo so that the ship shall float erect on an even keel; and further, he must control the center of gravity so that the ship shall be neither stiff nor cranky. A ship properly stowed should have the hold full and be down to her lines; usually a mixed cargo is required for this end; ships like ore carriers or colliers are designed to properly control the stability. Frequently ships that are properly stowed when at sea may become cranky in harbor during unloading and numerous accidents have happened in such cases.

There are indeed rules for insuring safety of the ship and its cargo; unfortunately they emanate from various sources, government laws, city and state regulations and the rules of classification societies. These rules are liable to be insufficient, inconsistent or contradictory. In too many cases regulations may be evaded if accidents are avoided. It would appear that some system of inspection should be possible to forestall evasion.

The importance of loading and unloading rapidly has been emphasized; when a good system is used effectively a ship can discharge cargo faster than it can be cleared from the wharf or quay; again it is necessary to accumulate freight for a ship and to have it properly sorted. A warehouse is essential for both purposes and should be worked in conjunction with the delivery of freight by trucks, railroad or lighters either to or from the ship. The smooth working of such a complicated system without hitch or interference calls for a correct plan, proper equipment and high administrative ability. Hand trucking to or from a warehouse becomes expensive and ineffective; it should be replaced or supplemented by electric traction of some type. A very flexible traction is by an electric truck with several trailers. The trailers may be loaded individually, made into trains and delivered where required. Such a train may run anywhere on the warehouse floor or wharf. A monorail track may be installed overhead out of the way and work quickly and effectively; it requires more head room and is not so flexible. Electric elevators for warehouses are worked by push buttons which deliver the cage very near the proper floor; an automatic electric device quickly adjusts the cage accurately to the floor.

The floors of a warehouse have good head room and goods must be properly tiered to use the room and avoid danger to containers and contents. This, together with the necessity for assorting the goods for convenience and accessibility, calls for intelligent planning and efficient superintendence. So simple a matter as turning each package so that its tag can be seen has its importance.

When we consider the variety, importance and complexity of the subjects treated in this book we appreciate the work of the authors in blazing the way.

An Investigation of the Fatigue of Metals is described in a 185-page pamphlet by H. F. Moore, research professor of engineering materials, and J. B. Kommers, research associate professor of engineering materials, published by the University of Illinois, Urbana, Ill., giving complete results of an investigation of this subject covered by the Engineering Experimental Station, University of Illinois, in cooperation with the National Research Council of the Engineering Foundation and the General Electric Company.

PERSONAL MENTION

Jasper Moon has been appointed manager of the Booth Steamship Company, Ltd.

W. L. Johnstone has been made assistant general passenger agent of the Pacific Mail Steamship Company, San Francisco, Cal.

A. T. Nott has been appointed superintendent of terminals for the Los Angeles Steamship Company. Mr. Nott was formerly dock agent for the company.

P. H. Lacy recently succeeded C. H. Marshall as district director of the United States Shipping Board at Savannah, Ga. Mr. Lacy was formerly district director at Boston.

P. K. Crocker, superintendent of European trades of the Shipping Board's traffic department in New York, has been appointed assistant to George H. Wells, traffic manager.

H. C. Cantelow, formerly with the Pacific Steamship Company, has been appointed Pacific Coast manager of the Luckenbach Steamship Company, Inc., with headquarters in San Francisco.

Hugh Gallagher, formerly general eastern representative of the Pacific Steamship Company, has become passenger manager of this company in California, with headquarters at San Francisco.

Captain R. C. Brennan recently assumed his duties as port captain for the Admiral Line at Seattle, Wash. He has just spent two years in the Orient as supervising port captain for the company.

William Altmansberger has been made superintendent of hulls and machinery of Geyelin and Company, Inc., at the Philadelphia office. Mr. Altmansberger has been connected with the Earn line and with the United States Salvage Association.

E. S. Leavitt has been appointed general agent of the Southern Pacific Railroad and the Morgan Line in Boston to succeed J. H. Glynn, deceased. Mr. Leavitt was manager of the traffic department of the Shipping Board in Boston for a period of four years and prior to this time was connected with the Southern Pacific.

George M. Skinner has been appointed manager of maintenance and repairs for the United States Shipping Board in San Francisco, Cal. At the present time Mr. Skinner is conducting a survey of the Pacific Mail liner *Empire State* in connection with the application made by the company to increase the present steerage capacity from 300 to 600 accommodations.

Norman F. Brown, formerly director of public works of Pittsburgh, Pa., has been elected vice-president and director of the Dravo Contracting Company, Pittsburgh, Pa. Prior to his connection with the city of Pittsburgh, Mr. Brown was assistant to the chief engineer of the Pennsylvania Railroad. During the war he was commissioned a major in the transportation corps of the American Expeditionary Forces.

Roger D. Lapham has been made a member of the firm of McCormick and McPherson of San Francisco, Cal. This company, which hereafter will be known as McCormick, McPherson and Lapham, has been appointed Pacific Coast agent for the Texas Oil Company. Mr. Lapham was for many years connected with the American-Hawaiian Steamship Company, first as agent in Seattle, then in Los Angeles and later as assistant traffic manager in San Francisco.

Captain Sir Bertram Hayes, of the White Star Liner *Olympic*, was recently given the title of commodore of the White Star fleet. In May, Captain Hayes will assume command of the new liner *Majestic* on her maiden trip in the New York-Southampton service of the White Star Line.

Richard H. Farley has been made passenger traffic manager of the International Mercantile Marine Company, New York. At the same time Thomas R. Thorne and D. D. Weipert were appointed assistant passenger traffic managers in charge of the first and second class departments and David Lindsay as assistant in charge of the third class department. Mr. Farley succeeds W. W. Jefferies, passenger traffic manager since 1906 and a member of the organization since 1882.

William M. Kennedy, who, as announced in the March, 1921, issue of Marine Engineering and Shipping Age, resigned as general works superintendent of the Chester (Pa.) yard of the Merchant Shipbuilding Corporation to accept a position with the repair department of the United States Shipping Board, has been appointed supervising local manager, North Atlantic district, of the Shipping Board vice J. J. Eason, resigned. Mr. Kennedy has had twenty years' experience in various branches of the shipbuilding industry, having served in various capacities with some of the largest private shipyards as well as in the Navy yards.

OBITUARY

John A. Donald, one of the original members of the United States Shipping Board, died at Rye, N. Y., on the morning of December 13, 1921, from an attack of pneumonia. He was selected as a member of the Board by President Wilson and took office in the spring of 1917, just at the time of our entry into the Great War. He was the only member of this Board who had had any shipping experience. Although born in Scotland, he came to this country in 1888 and took out his citizenship papers as soon as practicable. He spent his entire life in the shipping business and at the time of his appointment had organized and become president of the Donald Steamship Company. Although taking up public office at a time in life when he could have retired and spent the remainder of his life in ease, he devoted his untiring energy to the needs of the country in shipping which became of such vital importance during the war. His many years of experience proved of inestimable value to the Government in the performance of the responsible duties which were thrust upon him. Throughout the entire war and until the end of his term he devoted his time, energy and health to his country's demand. Many men, much younger than he, broke down under the terrific strain of public duties in those days, when the best each man had in him was required in the interests of the nation. Mr. Donald left office with his health shattered but with the consciousness of having performed his part in the great conflict to the uttermost of his ability. It was frequently a cause of wonderment of his confreres how he could bear up under the burdens which were placed upon him. His death at a time when he should have been enjoying a well-earned rest marks Mr. Donald as one of the sacrifices of the Great War as truly as though he had fallen on fields of Flanders. Mr. Donald was well and favorably known to the shipping public throughout the land. His patriotism and courage were inspiring to those associated with him. His genial disposition and his unfailing willingness to help all who applied to him for assistance will be greatly missed by his hosts of friends. His mortal remains were interred with appropriate ceremonies in the old Moravian cemetery, on the side of Staten Island hills, overlooking the sea, which he loved so well.

Shipping and Ship Operation News

Changes in Steamship Routes — Passenger and Freight Activities—Port Plans and Other Notes of General Interest

Steamships Brabantia and Limburgia Bought by American Ship and Commerce Corporation from Holland Lloyd Line

Biggest American Shipping Transaction Consummated—Steamers Are of 20,000 Gross Tons Each—Will Be Operated by United American Lines Between New York and Hamburg

ONE of the biggest transactions in the history of American shipping is seen in the announcement that the American Ship & Commerce Corporation, of which W. A. Harriman is chairman, has purchased the well-known passenger steamers *Brabantia* and *Limburgia,* of 20,000 gross tons each from the Royal Holland Lloyd Line. It is planned that these vessels will be transferred to the American flag at once, and that they will be placed in operation in the North Atlantic.

The *Brabantia* and *Limburgia* were built in Germany originally to the order of the Hamburg-American Line. They were in the course of construction when the war broke out. Work on them was suspended for a time, and they were not completed until 1920. Before the ships were finished they were sold to the Royal Holland Lloyd, under whose flag they first went into service.

The steamers are similar as regards general design and equipment, though differing in certain measurement details. The *Brabantia* is 596 feet long, has a breadth of 72.3 feet, and a depth of 40.2 feet; the *Limburgia* is 592 feet long, having a breadth of 72.3 feet and a depth of 39.7; both are oil burning, triple screw steamers of 17.5 knots speed. They have passenger accommodations for about 400 first class, 260 second class and 900 third class.

They will be operated between New York and Hamburg, with calls at French and English Channel ports. They will fly the house flag of the United American Lines, which is the operating organization for the American Ship and Commerce Corporation.

MOTOR BOAT SHOW

17th Annual Exposition at Grand Central Palace February 17-25

With the most successful automobile show ever held in New York City ended, interest in engines and motors turns to the 17th annual exposition of motor boats to be held in Grand Central Palace, February 17 to 25. This show holds the same important position in the motor boat world as the automobile display does in the motor car industry. Both are affiliated in many ways, and there are hundreds of persons who own and drive their own automobile, who also own and operate their motor boat.

The National Association of Engine and Boat Manufacturers, Inc., did not schedule a show last year because at the time such a display could have been held, Grand Central Palace, where the organization wanted to stage its exposition, was not available. As a result the interest in what the boat and engine builders will have to show this year is greater than ever. There will undoubtedly be new ideas in body building in the large cruisers. Speed craft will also attract because in this class of boats, engines of large horsepower figure just as much as body design. Runabouts which are the most popular craft in the nearby waters, of Sheepshead, Jamaica and Gravesend Bays will be displayed in large numbers.

During the past few years model yacht racing has become a most popular sport and the engine and boat manufacturers have recognized this. In fact, the international races between these miniature craft have become so important that the Central Park Model Y. C. is building fifteen class "B" boats for the elimination races to pick a defender against the boats W. J. Daniels, of England, will send here next summer. The Prospect Park Model Y. C. will have entries in these elimination contests, while the Montclair Model Y. C., the Irvington Model Y. C. and the Tacoma Model Y. C. have also entered the lists. The races will be held in June.

STEAMSHIP INTERESTS

At a recent conference with President Harding, attended by Secretary Hoover, and Mr. Lasker, over shipping rates for the Congressional Relief of Russia, the following arrangement was reached:

The Shipping Board would undertake to transport at cost, but American private shippers should be given priority in employment over the Shipping Board steamers so long as they were willing to quote fair rates.

It was considered that $1.50 per ton or so above going rates for foreign shipping represented approximately the difference in costs imposed upon American shipping by American shipping law and American wages and that approximately this figure should be used as a criterion in determining fair rates for private American shipping. The cooperation of the majority of American shipowners has been assured.

The United States Shipping Board has announced the allocation of sixteen vessels ranging in size from 4,145 tons to 10,914 tons, to various ocean and coastwise steamship line.

Three electric drive ships are now on the high seas on long voyages and latest wireless reports indicate that all are making satisfactory progress. The vessels are the *Archer* and the *Eclipse,* operated by the Barber Line, and the *Victorious,* which was recently allocated to the Black Diamond Line.

The Eastern Steamship Lines, Inc., have established a daily freight service between Boston and New York, which will be maintained by the steamers *H. F. Dimock, Herman Winter, Norwalk,* and *Delaware.* This is the first time that a daily strictly freight service has ever been attempted between Boston and New York, and it will be maintained all through the winter, according to present plans.

Old Dominion Transportation Co. May Purchase Vessel for Addition to Passenger Service Opening in Spring

Steamers "Hamilton" and "Jefferson" to Be Refitted for Resumption of Run Between Norfolk and New York—Line Suspended Since 1917 Responds to New Demand

BOAT passenger service between Norfolk and New York, suspended since 1917, is to be resumed this spring, the Norfolk Chamber of Commerce announced, and the steamers *Hamilton* and *Jefferson* are to be refitted as passenger steamers to be ready for the opening of the season.

Purchase of a third vessel by the Old Dominion Transportation Company is probable.

The *Hamilton* and *Jefferson* were passenger vessels until 1917 when they were taken over by the government, stripped of staterooms and converted into freight ships. When the Old Dominion Transportation Company was formed last year the ships were put on as freight carriers. It is stated that increased demand for additional passenger service has prompted the change.

Optimism for 1922 Expressed at Annual Conventions of Marine Engineers and Supplymen at Washington, D. C.

Outlook for Year Considered More Favorable—Delegates Hear Addresses and Call on President Harding—Smoker and Theatre Parties Entertain the Visitors

The forty-seventh annual convention of the National Marine Engineers Beneficial Association was held at the Hotel New Ebbitt, Washington, D. C., January 16-21, in conjunction with the annual convention of the Marine Engineers Supplymen's Association at the Raleigh. During the course of the engineers' convention the delegates were received by President Harding at the White House, and although the various representatives reported having gone through a period of severe business depression during 1921, there was considerable optimism expressed over the prospects for substantial improvement in 1922. Following are the association's officers for 1922: William S. Brown, president; William H. Hyman, vice-president; Samuel J. Hogan, conductor; J. E. Purdee, Chaplain; D. P. McCracken, door keeper; C. M. Sheplar, executive committee; William J. Barrett, executive committee.

President Brown called the convention to order at 9:30 A. M. on Monday, January 16, at the Ebbitt House and after the formal procedure of credentials and similar matters, Mr. Brown introduced Secretary of Labor Davis who was followed by General Wehler. There were about 350 officers, delegates, representatives and their wives in attendance.

On Wednesday the entire convention was escorted in a body to the White House where they were received by President Harding and on Wednesday night the France Packing Company entertained the ladies with an elaborate "Ladies Evening." The social event of the convention, a smoker, was tendered the delegates on Thursday night, January 19, by the Marine Engineers Supplymen's Association at the Willard Hotel, the ladies spending the evening at theatre parties.

Washington was selected as the convention city for 1923. As the present officers' terms have not yet expired, there was no election. The Supplymen's Association, by unanimous vote, elected MARINE ENGINEERING AND SHIPPING AGE to membership.

Officers of National Association: Left to right, D. P. McCracken, Doorkeeper; Samuel J. Hogan, Conductor; William H. Hyman, 2nd Vice-President; William S. Brown, President; George A. Grubb, Secretary-Treasurer; C. M. Sheplar, Executive Committee; William J. Garrett, Executive Committee; J. E. Purdee, Chaplain

Officers and Delegates of Engineers and Supply Men's Conventions on U. S. Treasury Steps, Washington, D. C.

Shipbuilding and Terminal Development

What the Shipyards Are Doing—Dry Dock Notes—Launchings—New Engineering Projects

$3,704,000 Asked for Marine Work by Department of Plant & Structures of New York in 1922 Requirements

$1,100,000 Asked for Construction of New East River Ferryboats and $550,000 for the Purchase and Reconditioning of Others—Balance Is for Ferry Terminals, Equipment, Etc.

A TOTAL of $3,704,000 for various marine work in connection with the building of new boats, ferry terminals and equipment incidental thereto is asked by Commissioner Grover A. Whalen, of the Department of Plant and Structures of the City of New York, in his recommendations for funds for 1922 to the Board of Estimate and Apportionment.

Included in the recommendations is a request for $1,100,000 for the construction of new ferryboats for the East River, which will probably be propelled by steam of Diesel engines, $550,000 for the purchase and reconstruction of existing ferryboats and $325,000 for constructing a new floating drydock. The funds requested for marine work during the year include the following:

Construction of new ferryboats for East River	$1,100,000
Purchase and Reconstruction of existing ferryboats	550,000
Completion of ferry terminals, Whitehall Street	400,000
Construction of floating dry dock, Atlantic Avenue	325,000
Vehicular approach connecting marginal way, St. George terminal	225,000
Reconstruction of shop to handle shafts and other heavy work, Atlantic Avenue	200,000
Plaza in front of Whitehall Terminal	200,000
Construction of ferry slips at Whitehall Street	116,000
Three electric bridges, Whitehall ferry slips	100,000
Reconstruction, Atlantic Avenue ferry terminal	76,000
Reconstruction, Hamilton Avenue ferry terminal	76,000
Reconstruction, Fulton Street, Brooklyn, terminal	66,000
Reconstruction, Fulton Street, Manhattan, terminal	60,000
Reconstruction of street level, etc., South Street terminal	50,000
Widening Viaduct, Richmond Terrace, S. I., to upper level of terminal	40,000
Additional coal bunkers at St. George, S. I.	30,000
Reconstruction, North rack and coal pier sheds at Astoria	30,000
Removing old ferryhouse, Whitehall Street	20,000
Construction of derricks in connection with dry dock	20,000
Construction of fire house and moorings at St. George for fireboat	10,000
Construction of foot bridge from Whitehall terminal to Battery Park	10,000

Six Dump Scows to Be Built By Street Cleaning Department During Year

It is reported that the Department of Street cleaning, of the City of New York, will place during 1922 contracts for six wooden side-dumping scows, which it is believed will cost close to $50,000 each. It is understood that the department is in need of these boats and that definite action will be taken toward the issuing of plans and specifications as soon as the question of patent rights is definitely settled.

"Mongolia" Awarded to Tietjen & Lang Yard of Todd Shipyard Corporation

The contract for reconditioning the steamship *Mongolia*, of the International Mercantile Marine Company, has been awarded to the Tietjen & Lang plant of the Todd Shipyards Corporation. The work to be done on the ship has to do chiefly with the construction and complete equipment of new third class accommodations besides the various other work incidental thereto and is practically the same as that now being done on the steamer *Manchuria* of the same company, which contract was also awarded to the Tietjen & Lang yard last week.

It is believed that the total amount involved for reconditioning both ships will probably be in excess of half a million dollars.

Todd Shipyards Corporation Buys Land of Mobile Shipbuilding Company

William H. Todd, of the Todd Shipyards Corporation, having shipbuilding and ship repair plants on both the Atlantic and Pacific coasts, has purchased the land on which the plant of the Mobile Shipbuilding Company was located during the World War and two years afterward. The purchase price is said to be $130,000. An offer of $165,000 for the material on the yards of the plant which was under the control of the United States Shipping Board, has been made by Fitzpatrick & Till, and is now under consideration.

Japanese Tanker Is to Have Peabody Burners

The Peabody Engineering Corporation, 331 Madison Avenue, New York City, has been awarded the contract for the Peabody-Fisher wide range fuel oil mechanical burners for the tank ship, now in course of construction at the yards of the New York Shipbuilding Corporation, Camden, N. J.

$8,200,000 Is Total Amount Required For Complete Reconditioning of Leviathan; Newport News Company Low Bidder

President Powell, of the Emergency Fleet Corporation, Gives House Subcommittee Approximate Final Figures on Cost of Putting Ship in Service

The steamship *Leviathan* can be completely overhauled and put in condition for trans-Atlantic service for a total cost of $8,200,000 according to a statement of President Joseph W. Powell, of the Emergency Fleet Corporation, at a recent hearing before the Subcommittee of the House Committee on Appropriations at Washington, D. C.

"In estimating the cost of reconditioning the *Leviathan*," Mr. Powell said, "the following figures have been used: The Newport News Shipbuilding & Dry Dock Company bid for reconditioning and conversion of the vessel to burn fuel oil, $5,595,000. The Newport News Shipbuilding & Dry Dock Company bid for repairs and machinery of the *Leviathan*, $515,000. The bid of Gimbel Bros., for equipment of steward's department of the *Leviathan* was $539,000; allowance for library, not included, $15,000; cost of moving the ship to the contractor's yard, insurance covering moving vessel to the contractor's yard, dry docking for 30 days, new anchors and chains, moving of ship to dry dock, and cost of the trial trip, $627,000; maintenance of steamer and guarding ship for 14 months' period during reconditioning—you understand we have to have this big force on board taking care of her all the time that work is being done—$680,000; inspection during reconditioning, $225,000, making a total of $8,166,000.

"So far as it is humanly possible to foresee the work that is to be done its cost is covered by the above estimate, and I believe we are giving you a figure that is thoroughly justified."

Many New Vessels Are Proposed For Addition to Various Government Departments During Ensuing Year

Two Diesel Electric Coast Guard Cutters, Diesel Electric Seagoing Dredge and Several Lighthouse Service Vessels Are Pending—Request for $730,000 for Lighthouse Vessels Awaiting Final Decision

ACTIVITY in the construction, during 1922, of various vessels for Government service is indicated in latest reports received by MARINE ENGINEERING AND SHIPPING AGE. In this connection it is stated that the United States Coast Guard is making plans and has asked for an appropriation for the construction of two coast guard cutters, one of 1,200 horsepower and one of 2,400 horsepower. The boats are to be propelled by Diesel electric engines, one to be equipped with four sets of 600 horsepower each, and one to be equipped with two sets of 600 horsepower each.

The War Department, it is understood, is preparing plans and specifications for a seagoing dredge 246 feet long, to be equipped with Diesel electric drive of six units of 500 horsepower each, or a total of 3,000 horsepower.

LIGHTHOUSE VESSELS

According to the Commissioner of Lighthouses of the Department of Commerce, careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service, it is found that sixteen light vessels and eleven tenders should be replaced within the next five years. Fifteen of these vessels are urgently needed.

NEED OF NEW SHIPS

Several of the older lighthouse tenders, the Commissioner reported, have reached the point where because of age and deterioration their usefulness and seaworthiness are impaired and they are greatly in need of replacement, being beyond economical repair. It is considered necessary to construct at least two tenders each year to maintain the fleet in an efficient condition.

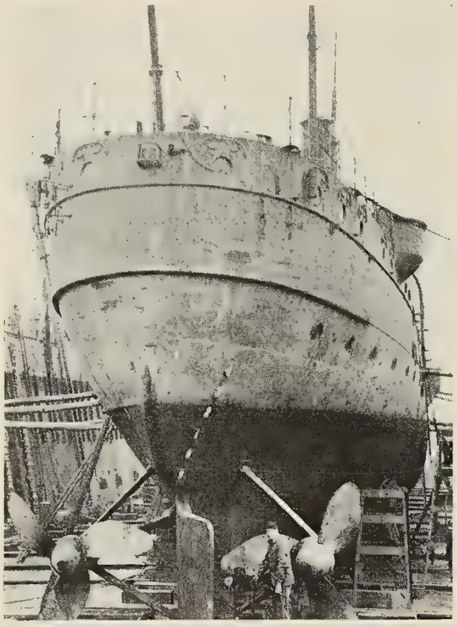
For the construction of new lighthouse vessels, a request for $730,000 is now pending before Congress. This amount is a reduction from $1,500,000 originally requested for two tenders and four light vessels. The Commissioner states that the Lighthouse Service maintains light vessels at forty-nine stations.

Former Spanish Warship Isla De Luzon, Captured at Manila Bay, Is Reconditioning for Salvage Service

The former warship *Isla de Luzon* is in drydock at the plant of the New York Harbor Dry Dock Corporation, Rosebank, Staten Island, N. Y., undergoing repairs and general overhauling in preparation for service as a salvage vessel. In addition to general alterations in accommodations and removal of gunboat equipment, she is being fitted with a new mast and derrick gear for handling heavy loads, and is also having heavy towing equipment installed.

Isla De Luzon's Bow Ram

This interesting vessel was built at the yard of Messrs. Swan, Hunter, and Wigham Richardson, at Newcastle-on-Tyne, England, in the year 1887, for the Spanish Government. She saw service in the Spanish American war where she was captured by Admiral Dewey at the battle of Manila Bay. She was later sold out of the United States Navy, and is still good for many years of useful work. She is in remarkable condition for a vessel of her age, and belongs to Sloan Danenhower & Company, of New York City, who are supervising her fitting out as a salvage vessel. The vessel is twin screw, propelled by two triple expansion engines working horizontally. Steam is supplied by four Scotch boilers. She is 192 feet long by 30 feet beam.



Stern View

London Steam Turbine Company Takes Over Steam Motors Company

The officers of the Steam Motors Company, having the belief that the Steam Motor is the best machine of its class in the market and realizing that it would be necessary to increase its capital in order that the Steam Motor should take its proper place in the industrial world, have on January 1, 1922, sold to the London Steam Turbine Company of Troy, N. Y., all of its assets, patents and interests, and from this date the Steam Motors Company will be known as the London Steam Turbine Company, of Troy, N. Y.

Mr. London, who was the president of the Steam Motors Company, and a turbine engineer of international reputation, will occupy the same position in this company.

Mr. DeLeon, the vice-president and general manager, brings to the company an experience of twenty-five years as a manufacturing executive with some of the largest concerns in the country.

Construction of Eight New Ships Is in Prospect for the Near Future

It is reported that the Eastern Steamship Company, of Boston, in conjunction with the Clyde Line, of New York, is contemplating the construction of two passenger ships, which it is expected will cost close to $2,000,000 apiece. Although complete details with regard to these ships are lacking at present, it is understood they will be about 420 feet in length and oil burning.

TO BUILD SIX MOTORSHIPS

The firm of Whittlesey & Whittlesey, naval architects, 17 Battery place, New York City, has issued plans and specifications for the construction of six combination cargo and passenger Diesel motorships. The ships are to be 225 feet in length; the engines of about 1,500 horsepower, driving the vessels at a speed of about 13 knots. The new ships are for the Tri-National Steamship Company, 17 Battery place, New York.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

New Feed Pumps, San Francisco, Cal.—It is reported that two new feed pumps will be installed in the Shipping Board steamer Golden State.

Speed Boat Contract, Neponset, Mass.—A contract for a 60-foot speed express runabout, designed by Henry J. Gielow, Inc., naval architects and marine engineers, 25 West 43rd Street, New York City, has been awarded to the George Lawley & Son Corporation. The boat is to be equipped with two 150-horsepower speedway motors to develop a speed of 27 knots.

Overhauling Job, Jacksonville, Fla.—The steamship Cuba, of the Peninsula & Occidental Steamship Company, plying in the Key West to Havana route, has been placed in dry dock at the plant of the Merrill-Stevens Dry Dock & Repair Company, to be scraped, painted and overhauled. The ship was put in service last February and this is the first time she will be in dry dock since being turned over by her builders.

General Overhaul, San Francisco, Cal.—The steamer Hanawa, a vessel of 12,000 tons, built for the United States Shipping Board and which has not yet been in commission, has been towed from her anchorage where she lay idle since her completion last June, to the Bethlehem shipyards at San Francisco, prior to being chartered by the Shipping Board to the Columbia Pacific Shipping Company, of Portland, Ore.

Shipbuilding Boom, Essex, Mass.—According to reliable information at least a dozen vessels to be added to the Gloucester fishing fleet will be ordered during the coming year. One of these craft is already on the stocks, work on the molds of another is going on, two others are a certainty and approximately eight more are planned. At the yard of J. F. James & Son the construction of the schooner Puritan is now well under way, and at the Arthur D. Story shipyard the preliminary work is being completed on the new craft for Captain Clayton Morrisey, patterned after the old Oriole. Plans are also being prepared for the construction of a new vessel for Captain Morton Selig, and Captain Ernest Parsons is to have a vessel built at Essex this winter.

Steel Piping Contract, Chester, Pa.—It is announced by J. L. Ackerson, vice-president, that the Merchant Shipbuilding Corporation has been awarded a contract by the Frederick Snare Corporation of New York for the furnishing of approximately six and a half miles of riveted steel piping, weighing about 10,000 tons, part of the extension line of the Catskill Aqueduct. The section contracted for extends from the neighborhood of Cold Springs to Ossining, New York. The contract amounts to more than half a million dollars.

Vessels to Be Overhauled, Jacksonville, Fla.—The steamship City of Miami, owned by the Havana-American Steamship Company, has been placed on the dry dock of the Merrill-Stevens Company to be scraped and painted and made ready for the winter Miami-Havana run. The big ferry steamer Joseph R. Parrott, which is operated by the East Coast Car Company between Key West and Havana, is also at the yard of Merrill-Stevens awaiting her turn to be placed in dry dock.

Reconditioning Contract, Brooklyn, N. Y.—The contract for reconditioning the All America Cable Company steamship Relay, bids for which were opened recently, has been awarded to the Tebo Yacht & Basin Company. Among other things, three boilers are to be installed in the ship, the prices for which were were not included in the figures submitted for hull and other work. The job amounts to $58,470.

Contract Award, Hoboken, N. J.—Bids for reconditioning the steamship Manchuria were opened in private at the offices of the International Mercantile Marine Company, New York City, on January 5. It was announced that the contract has been awarded to the Tietjen & Lang Yard, of the Todd Shipyards Corporation. It is believed the cost of the work will be in excess of $250,000. The principal work involved in the contract has to do with the construction and complete equipment and finish of new third-class accommodations and various other work incidental thereto.

May Purchase Steamers, Chicago, Ill.—It is reported that the Great Lakes Traffic Corporation is considering the purchase of ten ocean-going steamers, to be used in its Great Lakes service between Chicago, Ill., and Buffalo, N. Y.

Repair Job, Victoria, B. C.—Yarrows, Ltd., has been awarded the contract for repairs to the Government repair steamer Givenchy, which struck and was submerged for six weeks near Bella Bella three months ago. The work will cost about $10,000.

Steel Hull Contract, Manitowoc, Wis.—The Manitowoc Shipbuilding Corporation has a contract for the construction of a new steel hull for the tug J. H. Meyer. The vessel will be 99 feet over all, 22 feet beam and 12 feet 6 inches in depth. Although the present machinery will be used in the new hull, some replacements will be necessary.

To Remodel Steamship, Vancouver, B. C.—The Wallace Shipyards were awarded the contract for remodeling the steamer Admiral Farragut, the company being the lowest bidder at a price of $63,250. The work will require sixty days. After the Admiral Farragut is remodeled the Admiral Watson will undergo a general overhauling at the same yards.

Steamer Repairs, Hoboken, N. J.—The W. & A. Fletcher Company has been awarded the contract for the repair of the steamship Mount Clinton at a price of $6,000. The work includes hull and bottom damage repairs. The same yard has also been awarded the steamship Antietam, by the Shipping Board, for dry docking and overhauling of sea valves.

Two Passenger Ships, Boston, Mass.—It is reported that the Eastern Steamship Company, of Boston, in conjunction with the Clyde Line, of New York, is contemplating the construction of two passenger ships, which it is expected will cost close to $2,000,000 apiece. Although complete details with regard to these ships are lacking at present, it is understood they will be about 420 feet in length and oil burning.

New Ferries, New York.—In its requisition to the Board of Estimate and Apportionment for funds required during 1922 in order to carry out present plans, the Department of Plant and Structures of the City of New York asks $3,704,000, of which sum $1,100,000 is for the construction of new ferryboats and $550,000 for the purchase and repair of others.

May Build Barges, Rochester, N. Y.—The Rail and Canal Transportation Company is said to be contemplating having built eight 600-ton wooden canal barges for use on the route through the Erie Canal. As the company's trade involves long hauls, it is expected that a departure from the usual box-like design of the ordinary canal barge will be made and a shaped bow and stern adopted.

Will Construct Lake Steamer, Port Arthur, Ont.—The Port Arthur Shipbuilding Company has recently closed a contract for the construction of a lake steamer for the Mathews Steamship Company, which is to be ready for launching in October, 1922. The vessel is to be a steel freighter, 550 feet long. The company has placed 800 men on its pay roll to do the work on this ship, the material for which is being rushed to the head of the lakes as quickly as possible.

Reconditioning Ship, Hoboken, N. J.—The contract for rebuilding the engine foundations in the Hudson River steamship Hendrick Hudson has been awarded to the W. & A. Fletcher Company at a price of about $5,000.

To Purchase Steamer, San Francisco, Cal.—It is reported that F. M. Stark, vice-president of the Stark Steamship Lines, Inc., plans to purchase a 6,000-ton steamer for operation in the San Francisco-Portland service. Negotiations are now under way.

Diesel Engine Contract, San Francisco, Cal.—The Pacific Diesel Engine Company has been awarded the contract for building and installing two 525-brake horsepower Werkspoor Diesel engines in the automobile ferry now being constructed for the Golden Gate Ferry Company at the James Robertson Shipyard, Alameda, Cal.

Engine Installation, San Francisco, Cal.—The hull of the steamer Thomas Rolph, owned by George E. Billings, is at the China Basin plant of the Main Iron Works, undergoing engine installation. The vessel will be equipped with 1,000 horsepower triple expansion engines and will have a steaming radius of twenty days. When completed the vessel will carry about 1,400,000 feet of lumber.

Steamers to Be Overhauled, San Francisco, Cal.—Oliver Olson has procured the steamers Yolanda, Gabriel and the Ghislaine. The name of the Yolanda, which is the first to arrive, will be changed to Virginia Olson, and has been placed in dry dock for a general overhauling. The other two vessels will have their names changed after they have arrived at San Francisco and will receive a general overhauling as well.

Dredge Reconditioning, Charleston, S. C.—Among the contracts which the Charleston Dry Dock & Machine Company have in hand is the reconditioning of the United States dredge Barnard. Four Scotch marine boilers, built by the company, will be installed, and the vessel's hull and superstructure will be extensively repaired. The superheater installation, which will be by the Superheater Company, is especially interesting, it being the first instance in which superheated steam has been used on a United States dredge. The cost of the work is about $400,000.

New Vessels for Pleasure Resort, Milford, Del.—Burlington Island, New Jersey, is being equipped with an amusement park, fitted with the latest type of pleasure seeking devices, under the management of the Burlington Island Amusement Company, of which Captain L. H. Garrison has charge. It is expected that this will greatly increase passenger traffic to the Island, and increased facilities are being supplied by William E. Doron, who has just placed a contract for a small motor transfer boat with the William G. Abbott Shipbuilding Company for delivery in May, 1922. The Burlington Island Amusement Company is proceeding with arrangements to put in service new and faster vessels between Philadelphia and Burlington Island, which will maintain frequent service between these two points. The marine construction and rebuilding of the vessels for this service is under the supervision of Chapman & Fisher Company, Inc., 524 Walnut street, Philadelphia, Pa.

Towing Dredge, New York.—According to information obtained by Marine Engineering and Shipping Age, the Wah Chang Trading Corporation of China, represented in New York City by Sam Fung, is in the market for designs for a self-propelled steel, bucket, towing dredge to be worked out in America, partly fabricated in this country and erected in China. The boat is to be used as a towing barge as well as a dredge. It is understood the craft is to be 120 feet overall length, 22 feet 6 inches beam, by 8 feet deep, and is to have a compound surface condensing engine with a 13-inch high pressure cylinder, 27-inch low pressure cylinder and 16-inch stroke.

CONSTRUCTION FOR NAVY

Vessels under construction for United States Navy and their degree of completion as reported January 1, 1922, by the Bureau of Construction and Repair, Washington, D. C., are as follows:

Type Number and Name	Contractor	Percent of Completion Jan. 1, 1922
BATTLESHIPS (BB)		
45 Colorado	New York S. B. Corpn.	86.
47 Washington	New York S. B. Corpn.	69.8
48 West Virginia	Newport News S. B. & D. D. Co.	70.
49 South Dakota	New York Navy Yard	38.
50 Indiana	New York Navy Yard	34.3
51 Montana	Mare Island Navy Yard	27.6
52 North Carolina	Norfolk Navy Yard	36.7
53 Iowa	Newport News S. B. & D. D. Co.	31.2
54 Massachusetts	Beth. S. B. Corpn. (Fore River)	11.
BATTLE CRUISERS (CC)		
1 Lexington	Beth. S. B. Corpn. (Fore River)	31.1
2 Constellation	Newport News S. B. & D. D. Co.	20.
3 Saratoga	New York S. B. Corpn.	32.4
4 Ranger	Newport News S. B. & D. D. Co.	3.8
5 Constitution	Philadelphia Navy Yard	12.8
6 United States	Philadelphia Navy Yard	11.8
SCOUT CRUISERS (LIGHT CRUISERS) (CL)		
4 Omaha	Todd D. D. & Const. Corpn.	99.
5 Milwaukee	Todd D. D. & Const. Corpn.	93.6
6 Cincinnati	Todd D. D. & Const. Corpn.	87.6
7 Raleigh	Beth S. B. Corpn. (Fore River)	63.7
8 Detroit	Beth. S. B. Corpn. (Fore River)	76.9
9 Richmond	Wm. Cramp & Sons Co.	83.
10 Concord (a)	Wm. Cramp & Sons Co.	79.
11 Trenton	Wm. Cramp & Sons Co.	55.
12 Marblehead	Wm. Cramp & Sons Co.	47.
13 Memphis	Wm. Cramp & Sons Co.	40.
AUXILIARIES		
Repair Ship No. 1, Medusa (AR1)	Puget Sound Navy Yard	74.1
Dest. Tender No. 3, Dobbin (AD3)	Philadelphia Navy Yard	66.9
Dest. Tender No. 4, Whitney (AD4)	Boston Navy Yard	47.1
Sub. Tender No. 3, Holland (AS3)	Puget Sound Navy Yard	21.5
Aircraft Tender, Wright (AZ1)	Tietjen & Lang	Del. 12/16/21
PATROL VESSELS		
Gunboat No. 22, Tulsa (PG22)	Charleston Navy Yard	71.3
DESTROYERS		
338 Wasmuth	Mare Island Navy Yard	Com. 12/16/21
339 Trever	Mare Island Navy Yard	98.8
340 Perry	Mare Island Navy Yard	86.
341 Decatur	Mare Island Navy Yard	82.1

(a) Light cruiser No. 10 Concord—Launched 12/15/21.

Type Number and Name	Contractor	Percent of Completion Jan. 1, 1922
SUBMARINES		
115 S-10	Portsmouth, N. H., Navy Yard	94.9
116 S-11	Portsmouth, N. H., Navy Yard	92.8
117 S-12	Portsmouth, N. H., Navy Yard	92.5
118 S-13	Portsmouth, N. H., Navy Yard	90.7
123 S-18	Electric Boat Co. (Quincy)	97.
124 S-19	Electric Boat Co. (Quincy)	96.5
125 S-20	Electric Boat Co. (Quincy)	98.5
126 S-21	Electric Boat Co. (Quincy)	94.9
127 S-22	Electric Boat Co. (Quincy)	95.8
128 S-23	Electric Boat Co. (Quincy)	94.
129 S-24	Electric Boat Co. (Quincy)	93.
130 S-25	Electric Boat Co. (Quincy)	93.5
131 S-26	Electric Boat Co. (Quincy)	92.4
132 S-27	Electric Boat Co. (Quincy)	91.
133 S-28	Electric Boat Co. (Quincy)	91.6
134 S-29	Electric Boat Co. (Quincy)	90.5
136 S-31	Electric Boat Co. (San Fran.)	97.8
137 S-32	Electric Boat Co. (San Fran.)	96.9
138 S-33	Electric Boat Co. (San Fran.)	99.2
139 S-34	Electric Boat Co. (San Fran.)	95.9
140 S-35	Electric Boat Co. (San Fran.)	93.7
141 S-36	Electric Boat Co. (San Fran.)	91.7
142 S-37	Electric Boat Co. (San Fran.)	90.3
143 S-38	Electric Boat Co. (San Fran.)	84.6
144 S-39	Electric Boat Co. (San Fran.)	82.2
145 S-40	Electric Boat Co. (San Fran.)	81.2
146 S-41	Electric Boat Co. (San Fran.)	84.5
153 S-42	Electric Boat Co. (Quincy)	79.4
154 S-43	Electric Boat Co. (Quincy)	80.1
155 S-44	Electric Boat Co. (Quincy)	78.
156 S-45	Electric Boat Co. (Quincy)	78.7
157 S-46	Electric Boat Co. (Quincy)	77.3
158 S-47	Electric Boat Co. (Quincy)	76.5
159 S-48	Lake T. B. Co. (Bridgeport)	98.3
160 S-49	Lake T. B. Co. (Bridgeport)	97.7
161 S-50	Lake T. B. Co. (Bridgeport)	93.8
162 S-51	Lake T. B. Co. (Bridgeport)	92.4
FLEET SUBMARINES		
60 T-2 (SF 2)	Electric Boat Co. (Quincy)	99.3
163 V-1 (SF 4)	Portsmouth, N. H., Navy Yard	13.3
164 V-2 (SF 5)	Portsmouth, N. H., Navy Yard	11.4
165 V-3 (SF 6)	Portsmouth, N. H., Navy Yard	11.2

Note: Submarines authorized but not under construction or contract:

Fleet Submarines Nos. 166-171.

Neff Submarine (1) No. 108.

Barge Repair, Victoria, B. C.—The contract for repairs to the Canadian Pacific car barge, which was wrecked at Porlier Pass last month, has been awarded to the Victoria Machinery Depot at a price of approximately $50,000. The job will require several weeks for completion.

Extensive Repair Job, Newport News, Va.—The oil tanker F. D. Asche, recently almost a wreck off the Barbadoes, has been taken to the plant of the Newport News Shipbuilding & Dry Dock Company for repairs. The contract cost was figured at $391,000. The tanker, which was built at Newport News, will be reconditioned for the Standard Oil Company.

Seek Passenger Vessel, China.—It is reported that the China Mail Steamship Company has been looking for some time for a suitable passenger vessel to run in conjunction with the steamer Nile on their Hongkong, Straits Settlement and Singapore service. Although a canvass of the various ship markets of the world has been made by the company, no decision has yet been reached as to the selection of a vessel.

Overhaul of Freighters.—It is announced that the Shipping Board has started the overhauling of eight or ten freight steamers in order that they may be ready for sea as soon as possible, as recent inquiries received by the Board indicate that early use will be made of the vessels. The ships range from 6,000 to 9,000 tons, and are of the general cargo type.

Munalbro Contract Award, Brooklyn, N. Y.—Theodore Crane & Son, for a price of $3,900 and six days, has been awarded the contract for repairs to the Munson Line steamship Munalbro, which was recently damaged in a collision with the Crowell & Thurlow schooner W. F. Freeman. The steamer's starboard side and the bow were considerably damaged.

Vessel to Be Converted Into Transport, San Francisco, Cal. — The steamship West Lewark, a freighter which has been turned over to the army transport service of the War Department to replace the Dix, will undergo extensive alterations to fit her for transport service between the ports of Honolulu and San Francisco via Seattle. She has been placed on the dry dock of the Moore Shipbuilding Company, and while there will also be cleaned and painted.

Burner Installation, New York City.—The Peabody Engineering Corporation, 331 Madison avenue, has been awarded the contract for the Peabody-Fisher wide range fuel oil mechanical burners for the tank ship, now in course of construction at the yards of the New York Shipbuilding Corporation, Camden, N. J. The ship is building for the Japanese Imperial Navy, and is to be used for carrying coal as well as oil fuel for navy purposes.

Repair Contracts, Hoboken, N. J.—The steamship Storm King has been awarded to the W. & A. Fletcher Company for dry docking, repairs to hull damage, engines and auxiliaries and various other work. The same shipyard has also been awarded the S. V. Harkness, of the Standard Oil Company of New Jersey, for tank and machinery repairs, and the freighter Clement Smith, of the Calvert Navigation Company for repairs and reconditioning of turbines. The three contracts involve close to $10,000. The steamship Elliott, also of the Standard Oil of New Jersey, is at the Fletcher yard for dry docking and general repairs at a price of $5,700.

To Build Motorships, New York.—Bids for the construction of six combination cargo and passenger Diesel motorships, plans and specifications for which were issued recently by Whittlesey & Whittlesey, 17 Battery Place, New York, were opened on January 20. The ships will be 225 feet in length and will have a speed of 13 knots. These vessels are for the Tri-National Steamship Company, 17 Battery Place, and it is understood a portion of the new fleet will be used on the route between Boston and Halifax.

Steamers Overhauling, San Pedro, Cal.—The steamship Yale, of the Los Angeles Steamship Company, has been placed in dry dock by the Los Angeles Shipbuilding Company to undergo a complete overhauling. When the Yale resumes her run the company flagship, the Harvard, will undergo a similar overhauling.

Lighthouse Vessels, Washington, D. C.—According to the Commissioner of Lighthouses of the Department of Commerce, careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service, it is found that sixteen light vessels and eleven tenders should be replaced within the next five years. For the construction of new lighthouse vessels, a request for $730,000 is now pending before Congress.

Coast Guard Cutters, Washington, D. C.—The United States Coast Guard is making plans and has asked for an appropriation for the construction of two coast guard cutters, one of 1,200 horsepower and one of 2,400 horsepower. The boats are to be propelled by Diesel electric engines, one to be equipped with four sets of 600 horsepower each, and one to be equipped with two sets of 600 horsepower each.

Dredge, Wash., D. C.—The War Department, it is understood, is preparing plans and specifications for a seagoing dredge 246 feet long, to be equipped with Diesel electric drive of six units of 500 horsepower each, or a total of 3,000 horsepower.

SHIPYARDS AND DRYDOCKS

Shipyard Incorporated, Jacksonville, Fla.—It is announced that the Merrill-Stevens Dry Dock & Repair Company has been incorporated with a capital of $100,000 at Wilmington, Del., to acquire and operate shipyards, dry docks, etc.

Shipyard Addition, Fairfield, Md.—The Union Shipbuilding Company will call for bids in about a month for the construction of a two-story building 70 by 200 feet, to be erected at its plant. Revised plans for the structure are now under way. F. Stauffen is manager.

Yard to Be Dismantled, Bristol, Pa.—It is reported that the Shipping Board, Washington, D. C., will soon commence the dismantling of a portion of the Merchant Shipbuilding Corporation's plant at Bristol, and it is expected that cranes, crane runways and various yard equipment and other machinery will be placed on the market at an early date. The plant will, however, be operated by the Merchant corporation for some time to come.

Dry Dock Charges Reduced, Canada.—In order to be able to meet United States competition, the charges for the use of Canadian dry docks on the Pacific Coast have been reduced about one-third, or back to their pre-war level, for the next six months, at the end of which period the question of dry dock charges will have been considered and definitely settled by the Government. The graving dock at Esquimalt and the floating dry dock at Prince Rupert are affected by this reduction.

Shipyard to Resume Operation, Pensacola, Fla.—It is reported that operations at the plant of the Pensacola Shipbuilding Company will be resumed on a limited scale. At the present time there are under construction at the yard two steel barges and a snag boat, the latter to be shipped to South America. It is proposed to erect the snag boat and then take it down, mark the pieces and ship it to its destination in knockdown fashion.

PORT IMPROVEMENTS

Pier, Etc., Sanford, Fla.—The Chamber of Commerce contemplates the construction of a pier and boat basin. W. T. Donnelly is the marine engineer.

Docks, Tarpon Springs, Fla.—Willis Castaing, Mayor, has let a contract to the J. B. McCrary Engineering Company, Atlanta, Ga., for the construction of a concrete dock at the foot of Tarpon Avenue. This work will involve the expenditure of $236,000.

$900,000 Approved for New Pier, New York.—The Board of Aldermen of the City of New York at its meeting on December 27, 1921, unanimously adopted the report of the Committee on Finance in favor of adopting the ordinance providing for an issue of corporate stock in the amount of $900,000, which is for the removal of present pier No. 32, North River, the construction of new pier No. 32 and dredging of the north side of pier 31, the center of slip between pier 32, as proposed, and present pier 33.

Plans and specifications for the new pier will probably be under way by the Department of Docks early in 1922. The proposed new pier will be 200 feet wide and 1,021 feet long on the north

side, with reinforced concrete piles and foundation for a two-story shed for extra heavy loads on the roof. It is expected that the pier will be fitted with modern equipment which will be handled under a separate contract.

River Landing, Vicksburg, Miss.—The city will vote on $80,000 bonds, to be used for the construction of a river landing.

Deepening Channels, Levees, St. Louis, Mo.—According to Col. Charles L. Potter, president of the Mississippi River Commission, the sum of $6,670,000 will be expended during the year 1922 to deepen channels and protect the levees of the Mississippi River.

Deepening Harbor, Etc., Goderich, Canada.—The Department of Public Works, Ottawa, Can., plans extensive harbor improvements, including the deepening of the harbor at Goderich and improving and making additions to the docks. The cost of the work is estimated at $50,000.

Transit Shed, Tacoma, Wash.—All bids for the construction of a transit shed on the port docks were rejected by the port commission a few days ago, as they were above the $500,000 estimate made by the engineers. The drawing of new plans has been ordered, and bids will again be called for in about six weeks.

Wharf Construction, New Orleans, La.—It is reported that George R. Putnam, Commissioner of Lighthouses, recommends the construction of a wharf at New Orleans for the accommodation of lighthouse tenders. It is estimated that the cost of constructing and equipping the wharf will be $132,750. [illegible]intendent of Lighthouses of the New Orleans district, may be addressed concerning this project.

Dredging, Etc., Jacksonville, Fla.—United States Engineer O'Neil is making a survey of the upper part of the Charlotte harbor with a view to extending the channel to the retaining walls of Great Bridge, and dredging a turning basin between the bridge and the railroad docks at Punta Gorda. Further information may be obtained from the Mayor.

Dock, Hyder, Alaska.—E. J. Williams, who operates vessels on the mail route between Ketchikan and Hyder, Alaska, contemplates the construction of a dock at Hyder. It is stated that Mr. Williams is ready to proceed with the building of the dock, if arrangements can be made for the construction of an approach to it, the approach to be 2,200 feet long and to cost $10,000. The dock will cost about $5,000.

To Build Dock, Noble's Island, N. H.—The Standard Oil Company of New York has made an application to the City of Portsmouth, N. H., and the War Department, requesting permission for the construction of a large dock on property which has been controlled for many years by the Boston and Maine Railroad. The company contemplates making Portsmouth one of its big distribution points and sending its products to this port in large vessels.

New State Pier, Portland, Me.—Preliminary work in connection with the proposed state pier at Portland, Me., has been started. Contract for the removal of old wharves, etc., and dredging of some 150,000 cubic yards of material, involving the expenditure of approximately $70,000, has been awarded to the Aberthaw Construction Company, of Boston. It is expected the work will be completed early in April, at which time the construction of the pier itself will start.

Will Rebuild Pier, Sarasota, Fla.—The city contemplates the rebuilding of their 100-foot pier. For further information address the Mayor.

To Rebuild Wharf, San Diego, Cal.—It is reported that the Spreckles Brothers Commercial Company, San Diego, who handle the coaling for the entire port of San Diego, contemplate the redecking and remodeling of their coal bunkering wharf, the work to involve the expenditure of about $40,000.

Pier Construction, Portland, Maine.—According to the latest report, it is practically settled that the Port of Portland Commission will during this year construct Pier No. 3 at Municipal Terminal No. 4, this pier to be used temporarily as an open pier without transit shed. The new pier will be 1,500 feet in length and about 240 feet wide.

Crane Contract Award, Stapleton, S. I.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, has been awarded the contract for supplying mechanical equipment for the new Staten Island piers 12 and 13. The contract, known as contract A, amounts to $324,500, and calls for a large number of cranes of the most modern type.

Dredging, Jacksonville, Fla.—John Emmille was awarded the contract for dredging the harbor of Brunswick, Ga.

Seawall, Bay St. Louis, Miss.—The city contemplates the construction of a seawall to cost $100,000. Further information may be obtained by addressing the Mayor.

Pier, St. Petersburg, Fla.—It is reported that the Atlantic Coast Line Railroad will rebuild its pier at the foot of First avenue. W. H. Willoughby, Wilmington, N. C., is chief engineer for the company.

Dock, Canal, Etc., Hartford, Conn.—Plans have been prepared by the Water Commissioners of Hartford, Conn., for the South Meadows project, involving the building of docks, canals, a drainage system, etc. Fay, Spofford & Thorndike, 15 Beacon street, Boston, Mass., are the engineers.

To Improve Harbor, Louisiana.—A survey is being conducted by the Lake Charles Association of Commerce for perfecting the Calcasieu Parish Deeper Waterway Project and creating a port for Southwest Louisiana. A Federal appropriation of $780,000 is available for this work, and Parish will supplement the Government aid by a bond issue of $1,500,000.

Harbor Improvement, Cork, Ireland.—The Harbor Commissioners, Cork, Ireland, reported at a meeting held a short time ago that they had decided to secure the services of the American engineer, Mr. Nicholson, who is advisory engineer to the Port of Seattle, to advise on the improvement scheme in Cork harbor, on which £1,000,000 is to be expended.

Pier, Philadelphia, Pa.—A contract for the construction of piers for the bridge connecting Philadelphia and Camden, N. J., has been awarded to the Keystone State Construction Company of Philadelphia, Pa., and the firm of Holbrook, Cabot & Rollins, of Boston, by the joint Delaware River Commission. The bid, made jointly by the two firms, amounted to $1,669,775. Work on these piers will probably be commenced on January 6.

GOVERNMENT WORK

The following specifications are available at or in contemplation by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for various work on material as listed below:

Power Plant Equipment, Bellevue, D. C.—Bids are being received for 150 horse-power return tubular boilers and mechanical stokers, boiler and fire pumps, motor-driven air compressor or brick setting and superheaters for four boilers, crane, two turbine-driven forced draft fans, air condenser and circulating pumps, pipes, etc., to be furnished and installed. Specification 4497.

Reservoirs and Dispensary, Yorktown, Va.—Construction at mine depot planned. Specification 4565.

Storage Buildings, Pearl Harbor, T. H.—Mine storage building at the ammunition depot planned. Specification 4567; and five buildings for torpedo and ammunition storage at the same depot; Specification 4566.

Motor Generator Set, Hampton Roads, Va.—Installation of motor generator set and switchboard at the naval operating base planned. Specification 4570.

Steam Piping System, Yorktown, Va.—Installation planned. Specification 4573.

Operating and Power Building, Etc., Tatoosh, Wash.—Operating and power building with accessories at the naval radio station contemplated. Specification 4574.

Dredging, Norfolk, Va.—A contract for dredging 200,000 cubic feet in order to deepen the waterfront of the Navy Yard at Norfolk has been let to the Jones Dredging Company, Norfolk.

Storehouse, Pearl Harbor, T. H.—Specification 4504. The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded a contract to W. F. Martens, 53 Franklin Street, Rochester, N. Y., for the construction of a one-story storehouse, the price being $196,775. Two hundred and sixty-three days will be required for the completion of the work.

Dredging, Los Angeles, Cal.—The District Engineer has awarded a contract to the United Dredging Company, Central Building, for dredging in Los Angeles harbor, the work to cost $37,340.

Dredging Plant, San Diego, Cal.—The United States Engineer has awarded a contract to the Olympian Dredging Company, 249 First avenue, San Francisco, Cal., for the hire and operation of a dredging plant at a price of $125,000.

NEW INCORPORATIONS

The Empire Steamship Company, Manhattan, has been incorporated, with a capital of $50,000, by F. Leftwich, J. L. Smith and L. Dunkelman. F. Weinstein, 165 Broadway, New York, is attorney.

The Commercial Pilot Steamship Company, Ltd., has been incorporated in Wilmington, Del., with a capital of $100,000, to build, own and operate boats.

The Inter-Coastal Steamship Company has been incorporated in Dover, Del., with a capital of $1,000,000, to engage in ocean commerce.

The Arconstruct-Hullfin Engineering Company has been incorporated with a capital of $100,000 under the laws of Delaware to carry on the business of naval architecture and marine engineering, operating under exclusive Arconstruct-Hullfin combination patent rights held by C. V. S. Wyckoff, naval architect and consulting engineer. The officers of the new company are as follows: C. V. S. Wyckoff, president; F. F. Boyd, vice-president; Frank Nichols, vice-president; Morgan Olcott, secretary, and Robert B. Palmer, Jr., treasurer.

The Terminal Iron Works Co. has been organized by Harry W. Fawke, of San Francisco, former superintendent of hull construction at the Moore Shipbuilding plant, and Edward McKarley, of Stockton, who have acquired the plant and property of the Stockton Iron Works for the manufacture of steel and iron products. The company is considering the establishment of a branch plant for ship repair work, to be operated in conjunction with their structural department.

FOREIGN ACTIVITIES

New Port, Rocky Point, Mex.—A new port terminal is being constructed by the Tucson, Gila Bend and New Cornelia Railroad at Rocky Point on St. George's Bay, Gulf of California, on the mainland about 100 miles north of Guaymas. The company proposes in this way to provide an outlet for the products of the Arizona copper mines.

Provisional Wharf.—The Mexican Government is reported to have approved plans and considerable materials have been ordered for the construction of a provisional wharf at Manzanillo. The new wharf will be about 450 feet long and 45 feet wide, with a draft alongside of not less than 30 feet.

Wharf Construction.—It is announced from Guayaquil that the recent Congress of Ecuador has authorized the letting of contracts for the construction of a wharf and custom house at Guayaquil in connection with other projects. Funds for the port construction are to be provided in part, either at public auction of Government owned land in Guayaquil or by loans secured by these lands.

New Harbor, Gisborne.—The Marine Department of New Zealand Government has approved and adopted the plans prepared for the proposed harbor at Gisborne.

Site for Port, Komarno, Poland.—The Czecho-Slovak Government has acquired a site at a price of half a million kroner at the town of Komarno on the Danube for the purpose of establishing a port.

Shipbuilding, Germany.—According to the American Bureau of Shipping, German shipyards turned out about 400,000 gross tons of ships in 1921. One hundred steel ships, ranging in size from 1,500 to 10,000 tons, are included in this figure. Of these 100 vessels six were motorships aggregating 30,284 gross tons. German shipbuilding now ranks second to that of Great Britain.

BUSINESS NOTES

William Homes Davis, president of the Virginia Forwarding Corporation is the new president of the Hampton Roads Foreign Trade Club.

B. C. Colonna, of the Colonna Marine Railway Corporation, is the new president of the Norfolk Ironmasters' Association, an organization of ship repair plants.

The Bird-Archer Company has moved its New York office from 90 West street to 33 Rector street.

Messrs. Rossell and Thayer, naval architects and marine engineers, Forrest Building, Philadelphia, Pa., have been made the sales engineers and exclusive agents of the Superior Iron Works Company of Superior, Wis., for the territory from Portland, Maine, to Norfolk, Va. They handle steam and electric deck machinery and steering gears and special dredging machinery, as well as a patented steam scow winding gear.

The twenty-fifth annual meeting of the American Society for Testing Materials will be held on June 26-July 1, 1922, at Atlantic City, N. J., with headquarters at Chalfonte-Haddon Hall Hotel.

O. M. Rau, formerly consulting engineer to the Philadelphia Rapid Transit Company, has become associated with the Hardinge Company, Inc., 120 Broadway, New York, and will specialize in the handling of Quigley Pulverized Fuel Systems as applied to boilers. W. O. Rankin has also become associated with the Hardinge Company, in the capacity of managing engineer of the Quigley Pulverized Fuel Department. These changes have taken place with the acquirement by the Hardinge Company, Inc., of the Pulverized Fuel Department of the Quigley Furnace Specialties Company.

William Thompson, district manager for the Texas Company has been elected president of the Hampton Roads Maritime Exchange for the year 1922.

The Pneumercator Company, Inc., announces the removal of its factory from Philadelphia, Pa., to the Sperry Building, 40 Flatbush Avenue Extension, Brooklyn, N. Y., on February 1. Its general offices at 15 Park Row, New York, will be located at the new factory after February 1.

George W. Green has resigned as assistant general manager of the Los Angeles Steamship Company, San Francisco, Cal., to become general assistant to A. J. Frey. He formerly was Mr. Frey's assistant in the Pacific Mail construction division of the Shipping Board and Los Angeles Steamship Company.

TRADE PUBLICATIONS

Soot Blowers in Marine Boilers.—The Diamond Power Specialty Company, Detroit, Mich., has recently published an enlarged and revised edition of bulletin 134, "How Some Ship Owners Have Increased their Profits." This book deals with soot losses in coal and oil fired boilers, with a special section devoted to the latter type. In addition, the bulletin describes and illustrates in detail the automatic rear end front operated soot blower for double and single ended Scotch boilers, the front end oscillating type, the revolving type for water-tube boilers, the Diamond system for hollow staybolts in horizontal baffled water-tube boilers. This bulletin may be obtained from the Detroit or New York offices of the company.

Centrifugal Pumps.—An instruction book dealing with the construction and installation of centrifugal pumps of the VH type, class B, BS and OS has been issued by the Worthington Pump & Machinery Corporation, N. Y. Actually this might be termed a hand book on centrifugal pumps for the use of operating engineers. Complete details for the erection of pumps are given in the first part of the book, followed by curves showing the maximum water temperature allowable for different suction lifts. Farther along curves are given of the head capacity and efficiency capacity characteristics of the centrifugal pump. The various types of pumps are described in detail and many useful tables of data given. Readers may obtain copies of the book from the company by asking for bulletin No. 605-L.

Machine Tools.—The "Triplex" No. 1 machine tool designed for turning and boring, milling, thread cutting and drilling is described in detail and its application to each of these operations in a pamphlet sent out by the Triplex Machine Tool Corporation, New York. The advantage of this machine is that it combines a number of machine tools in one, cutting down equipment investment and saving floor space. A price list is included in the pamphlet.

"Bridging Two Oceans and Linking Four Continents" is the title of a booklet, recently issued by the Canadian Pacific Railway, which contains descriptions of the company's steamship services and various facilities offered. It tells of the company's ocean tonnage of 800 growing into over 465,000 tons, and the one service into numerous ones by which Canada is now linked with four continents. Illustrations and descriptions of the more pretentious vessels, including the *Empress of Canada*, a vessel of 22,500 tons, *Empress of Australia*, etc., are given, as well as illustrations of the various ports in all countries of the world which are linked by the Canadian Pacific services. Special mention is made of their oil-burning vessels and their particular advantages.

"Old Ironsides"—A decorative calendar carrying a history and reproduction of a painting of the famous frigate *Constitution* is being distributed by the Columbian Rope Company, Auburn, N. Y. A bulletin describing the complete process of the manufacture of Columbian pure manila, tape marked rope is also available. The company will be pleased to send these on request.

MARINE SOCIETIES

AMERICA

AMERICAN SOCIETY OF NAVAL ENGINEERS

Navy Department, Washington, D. C.

President—Capt. A. J. Hepburn, U. S. N.

Secretary-Treasurer—Commander J. S. Evans, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Annual meeting and election, first Tuesday in October, other meetings at call of the President.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS

29 West 39th Street, New York.
President—Walter M. McFarland.
Secretary and Treasurer—Daniel H. Cox.

NATIONAL ASSOCIATION OF ENGINE AND BOAT MANUFACTURERS

29 West 39th Street, New York City.

UNITED STATES NAVAL INSTITUTE

Naval Academy, Annapolis, Md.
President—Rear Admiral Bradley A. Fiske, U. S. N.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

NATIONAL ASSOCIATION OF MASTERS, MATES AND PILOTS

National President—John H. Pruett, 423 Forty-ninth St., Brooklyn, N. Y.
National Treasurer—A. B. Devlin, 187 Randolph Ave., Jersey City, N. J.
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

LIST OF OFFICERS, AMERICAN SOCIETY OF MARINE DESIGNERS

President—E. H. Monroe, Washington, D. C.
Vice-President—C. C. Jacobson, New York City.
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass.
Treasurer—J. B. Sadler, Norfolk, Va.
Executive Committeemen—John Thomson, Bethlehem, Pa.; A. H. Haag, Baltimore, Md.; C. D. Anderson, Washington, D. C.

NATIONAL MARINE ENGINEERS' BENEFICIAL ASSOCIATION

Headquarters 311-315 Machinists Building, Washington, D. C.
President—Wm. S. Brown.
Secretary-Treasurer—George A. Grubb.

ATLANTIC COAST SHIPBUILDERS' ASSOCIATION

1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

AMERICAN STEAMSHIP OWNERS' ASSOCIATION

11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

UNITED STATES SHIP OPERATORS' ASSOCIATION

149 Broadway, New York
President—C. H. Potter

CANADA

GRAND COUNCIL, N. A. OF M. E. OF CANADA

Grand President—E. Read, Rooms 10-12, Jones Building, Vancouver, B. C.
Grand Vice-President—Jeffrey Roe, Levis, P. Q.
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.
Grand Conductor—E. A. House, Box 333, Midland, Ont.
Grand Door Keeper—Lemuel Winchester, 306 Fitzroy Street, Charlottetown, P. E. I.

GREAT BRITAIN

INSTITUTION OF NAVAL ARCHITECTS

5 Adelphi Terrace, London, W. C.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND

39 Elmbank Crescent, Glasgow.

NORTHEAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS

Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

INSTITUTE OF MARINE ENGINEERS, INCORPORATED

The Minories, Tower Hill, London.

ITALY

COLLEGIO DEGLI INGEGNERI NAVAL E MECCANICI IN ITALIA.

Via Carlo Alberto 18, Genova.

Marine Engineering
and Shipping Age

Volume XXVII March, 1922 Number 3

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
S. M. Phillips, Associate Editor L. S. Blodgett, Associate Editor
W. Z. Gardner, News Editor

Contributing Editors

Rear Admiral C. W. Dyson, U. S. N. William Gatewood
Commander S. M. Robinson, U. S. N. H. McL. Harding
Professor C. H. Peabody William T. Donnelly
Captain C. A. McAllister, U.S.C.G. (Retired) James L. Bates

WE GUARANTEE that of this issue 5,400 copies were printed; that of these 5,400 copies 4,076 were mailed to regular paid subscribers; 337 were provided for counter and news company sales; 213 were mailed to advertisers; 27 were mailed to employees and correspondents and 738 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 16,450—an average of 5,490 copies a month.

Marine Engineering is a member of the Associated Business Papers, Inc. (A. B. P.) National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulations (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

The President's Message

THE President's long-expected message was delivered before a joint session of the two Houses of Congress on February 28. As predicted in the February issue of this magazine, the President recommended a direct subsidy to all ships engaged in foreign commerce amounting to a maximum of about $30,000,000 per annum or in the neighborhood of 10 percent of the anticipated revenue from customs.

In addition to a subsidy, he recommended several forms of indirect aids which should be highly constructive without being a drain upon the public treasury. The message contains over 4,000 words, and it is an able and convincing plea for the same sort of protection for shipping that is given to our other industries. The President's plan is as follows:

"What, then, is our problem? I bring to you the suggestions which have resulted from a comprehensive study which are recommended to me by every member of the United States Shipping Board. It is a program of direct and indirect aid to shipping to be conducted by private enterprise. It is proposed to apply generally the benefits which it was designed to derive from discriminating duties to all ships engaged in foreign commerce, with such limitation on remuneration as will challenge every charge of promoting special interests at public cost.

"In lieu of discriminating duties on imports brought to us in American bottoms it is proposed to take 10 percent of all duties collected on imports brought to us in American or foreign bottoms, and create therefrom a merchant marine fund. To this fund shall be added the tonnage charges, taxes and fees imposed on vessels entering the ports of continental United States, also such sums as are payable to American vessels by the Post Office Department for the transportation by water of foreign mails, parcel posts excepted.

"Out of this fund shall be paid the direct aid in the development and maintenance of an American merchant marine. The compensation shall be based on one-half of 1 cent for each gross ton of any vessel, regardless of speed, for each 100 miles traveled. When the speed is 13 knots or over, but less than 14, two-tenths of a cent on each gross ton shall be added; for 14 knots, three-tenths of a cent; for 15 knots, four-tenths of a cent; for 16 knots, five-tenths; for 17 knots, seven-tenths; for 18 knots, nine-tenths; for 19 knots, eleven-tenths; for 20 knots, thirteen-tenths shall be added to the basic rate. For 23 knots the maximum is reached at 2.6 cents for each gross ton per 100 miles traveled.

"I will not attempt the details of requirements, or limitations, save to say that all vessels thus remunerated shall carry the United States mails, except parcel post, free of cost, and that all such remuneration must end whenever the owner of any vessel or vessels shall have derived a net operating income in excess of 10 percent per annum upon his actual investment, and thereafter the owner shall pay 50 percent of such excess earnings to the merchant marine fund, until the full amount of subsidy previously received is returned to its source. In other words, it is proposed to encourage the shipping in foreign trade until the enterprise may earn 10 percent on actual investment, whereupon the direct aid extended is to cease and the amount advanced is to be returned out of a division with the Government of profits in excess of that 10 percent. The provision makes impossible the enrichment of any special interest at public expense, puts an end to the Government assumption of all losses, and leaves to private enterprise the prospective profits of successful management.

"Of the indirect aids there are many, practically all without draft upon the public treasury, and yet all highly helpful in promoting American shipping.

"It is a simple thing—seemingly it ought not require the action of Congress—but American officials traveling on Government missions at Government expense ought to travel on American ships, assuming that they afford suitable accommodations. If they do not afford the requisite accommo-

dation on the main routes of world travel, the argument that we should upbuild is strongly emphasized.

"I think we should discontinue, so far as practical, the transport services in the Army and Navy, and make our merchant and passenger ships the agents of service in peace as well as war.

"We should make insurance available at no greater cost than is afforded the ships under competing flags, and we can and will make effective the spirit of section 28 of the Jones Act of 1920, providing for preferential rail and steamship rates on through shipments on American vessels. American railways must be brought into cooperation with American steamship lines. It is not in accord with either security or sound business practice to have our railways furthering the interests of foreign shipping lines, when the concord of American activities makes for common American good fortune.

"Contemplating the competition to be met, there ought to be an amendment to the interstate commerce act which will permit railway systems to own and operate steamship lines engaged in other than coastwise trade. There is measureless advantage in the longer shipments where rail and water transportation are coordinated, not alone in the service but in the solicitation of cargoes which ever attends an expanding commerce.

"We may further extend our long-established protection to our coastwise trade, which is quite in harmony with the policy of most maritime powers. There is authority now to include the Philippines in our coastwise trade, and we need only the establishment of proper facilities to justify the inclusion of our commerce with the islands in our coastwise provisions. The freedom of our continental markets is well worth such a favoring policy to American ships, whenever the facilities are suited to meet all requirements.

"Other indirect aids will be found in the requirement that immigration shall join wherever it is found to be practical in aiding the merchant marine of our flag under which citizenship is to be sought, and in the establishment of the merchant-marine naval reserve. The remission of a proportion of income taxes is wholly compatible when the shipping enterprise is of direct Government concern, provided that such remission is actually applied to the cost of new ship construction.

"Congress has already provided for a loan fund to encourage construction. It might well be made applicable to some special requirements in reconditioning.

"It is also worth our consideration that, in view of suspended naval construction, the continued building of merchant ships is the one guaranty of a maintained shipbuilding industry, without which no nation may hope to hold a high place in the world of commerce or be assured of adequate defense.

"A very effective indirect aid, a substitute for a discriminating duty which shall inure to the benefit of the American shipper will be found in the proposed deduction on incomes, amounting to five percentum of the freight paid on cargoes carried in American bottoms. The benefits can have no geographical restrictions, and it offers its advantages to American exporters as well as those who engage in import trade."

The Great Lakes-St. Lawrence Waterway

JUDGING from editorial comment in the newspapers of the interior, the proposed Great Lakes-St. Lawrence waterway has considerable support in at least eighteen of the middle-western states. President Harding endorsed the project in a speech before the National Farm Conference on January 23 and it has since been announced that Secretary Hughes has been directed to negotiate a treaty with Great Britain under which the United States and Canada can jointly undertake the building of a shipway from the lakes through the St. Lawrence river to the Atlantic. Representative Mapes of Michigan has introduced a bill in Congress authorizing the President to spend $100,000 to defray the expenses of the American members of an international commission to work out the plans for a thirty-foot channel and for the development of water power.

If this proposed waterway is constructed, the water power that it can develop will be its real justification; for the cost of construction and maintenance of a canal must be considered in the total cost of transportation over a waterway just as the cost and maintenance of a road bed must be added to the price of transportation of a railroad. It is certain that shipping could defray neither the cost nor the maintenance of this project because the saving that is possible in avoiding a transfer of cargo at the seaboard would be largely offset by the extra time that a ship would lose in making its way at a reduced speed through the locks and narrow channels of such a long waterway. However, as a power project, it might be a good investment and on this subject some interesting figures are given.

Col. W. P. Wooten, Corps of Engineers, U. S. A., and W. A. Bowden, chief engineer, Department of Railways and Canals, Canada, who were appointed by their respective governments to investigate the possibilities of this improvement, report that $252,728,200 will be necessary for the complete improvement for navigation purposes and the development of approximately 1,464,000 horsepower delivered at the switchboard. Mr. Paul T. Brady of the Westinghouse Electric and Manufacturing Company figures that the 1,464,000 horsepower, which is equivalent to about 1,100,000 kilowatts, would deliver in 7,000 of the 8,760 hours in a year 7,700,000,000 kilowatt hours to sell. He estimates the fixed charges, maintenance and amortization charge to pay the debt in fifty years at $13,049,232 per annum, which, if taxes are eliminated, would make the cost of a kilowatt hour something less than 2 mills.

To distribute this power over a 300-mile radius, it is estimated that $75,000,000 additional would have to be spent for transmission lines and towers and that this cost would have to be financed by private interests. Assuming $9,000,000 as a fair charge per annum to take care of the interest, depreciation, operation, maintenance and amortization of the $75,000,000, the cost of the power would be about 3½ mills per kilowatt hour as compared with 1 cent per kilowatt hour that it costs New York today to generate power from coal.

If the above figures are approximately correct, and the project is completed, it appears that the lake seaports would

be presented with an outlet to the ocean which would undoubtedly have a stimulating effect on shipping and the industrial development of the interior. The people of the Middle West are not apt to feel the vital interest which they should in an adequate merchant marine, notwithstanding the fact that American shipping is just as important to the welfare of those states as it is to the seaboard. The construction of this waterway might do much to bridge the gap in the shipping perspective now existing between the seaports and the interior.

A Brighter Outlook

THE month of February marked a definite improvement in the shipping and shipbuilding situation. Numerous inquiries for the chartering and building of passenger ships were current in January but, outside of a few reconditioning jobs, such as the *Manchuria, Mongolia* and *Ruth Alexander* (ex-*Callao*), nothing of importance had actually developed. It is common knowledge that a thorough search has been made for passenger tonnage, and it has been found that vessels of this class ready for service under the American flag are not to be obtained in the market.

The first contract for the year for the construction of two new passenger vessels was awarded to the Wilmington plant of the Pusey and Jones Company early in February. These vessels, which are to be 330 feet long, 58 feet beam and of 2,750 gross tonnage, are for the Seaboard Bay Line. Each ship will have 175 staterooms and special bedrooms, all of which will be fitted with the most up-to-date improvements.

The big event of the month was the awarding of the contract to recondition the *Leviathan* to the Newport News Shipbuilding and Dry Dock Company. This is the greatest single step that the new Shipping Board has made toward placing our merchant marine on an equal basis with our foreign competitors. It is highly significant, indicating, as it does, that the board is confident that Congress will support the shipping legislation that is to be recommended by the President and that the appropriations requested by the board will be granted.

Another thing, it is apparent that, although the *Leviathan* will be second to none as a passenger liner when completed, she will require two other ships to work in combination with her. Two such ships of express speed are available, the *Agamemnon* and *Mount Vernon*. Both of them can be reconditioned in eight months' time at a total cost of less than the sum that will be spent on the *Leviathan*. The present indications of heavy passenger travel during the season of 1922 show that good use can be made of these vessels.

The passage of subsidy legislation will undoubtedly release several orders. The American Bureau of Shipping reports that there are substantial inquiries for at least a dozen sea-going ships, most of which are passenger vessels, and that there is a decided shortage of this type of craft in the United States. While inquiries are not necessarily contracts, yet, when the Bureau uses the term "substantial inquiries" it undoubtedly means that the contract plans of these proposed ships have been submitted to the Bureau for advice and suggestions relating to future classification.

The Shipping Board at the time of this writing has placed 46 idle ships in commission since January 1, and it is reported that it contemplates allocating 40 more in the near future. A number of these have been chartered on the bare boat plan, thus assuring the board of a profit rather than a loss on their operation.

Another forward step is the betterments now under way on the State ships allocated to the United States Lines. The *Lone Star State* and the *Peninsula State* when completed will carry first and third class passengers only. These ships should be highly successful as their third class accommodations are the equal in location and quality to the second class accommodation on other liners, while the first class accommodations are better than can be obtained elsewhere for the same price.

The *Centennial State, Old North State* and *Panhandle State* are being converted to cabin ships carrying one class only. By placing a convertible upper and lower berth in each stateroom, thus berthing four instead of two per room, it will be possible to halve the price of the passage. These ships will certainly appeal to persons in moderate circumstances and will no doubt make it possible for many to travel who otherwise would not.

Advertising American Passenger Liners

IN view of the attacks that have been recently made in Congress against the Shipping Board policy of advertising American passenger ships, we are inclined to wonder whether the destructive criticism that certain newspapers—notably the important dailies of New York City—have directed against any attempt to build up an American merchant marine along the lines successfully adopted by our foreign competitors is not having a most decided and injurious effect upon some of our legislators.

The notorious fact that a number of our patriotic public officials travel on foreign passenger liners every chance they get ought to be a sufficient reason to any fair minded Congressman that the general public, who are not supposed to be so well informed on matters affecting the general welfare of the nation, should be advised through high class advertising of their own passenger ship services. If public officials prefer foreign ships, it is all the more important to direct the attention of the traveling public to the fact that they own a number of high class safe and comfortable ships themselves and that the Shipping Board, through some of the best known steamship lines, is operating these ships for their own benefit.

We don't want to hog all the commerce for American ships, either freight or passenger, but we do want a fair share. Government statistics show that approximately 250,000 Americans travel by sea from the United States every year. Suppose one-half or 125,000 of these travelers attempted to patronize their own ships, what would be the consequence? Nothing less than that the shipyards of this country would be busy creating new tonnage. The allied trades would be working overtime furnishing equipment and fittings for the best ships that the world has ever seen. Yes, and of far more importance than this, our present naval strength in desirable convertible merchant tonnage would begin to assume something like a proportion to the 5-5-3 naval ratio that our statesmen have made the general public believe indicates the comparative strength of our Navy.

The Navy Yards Are for the Navy

We have just witnessed a very narrow escape from a serious injury to our merchant marine. Although most everyone knows that the recent reduction in our naval strength makes an efficient merchant marine doubly important, yet we have seen a determined attempt by the politicians of Massachusetts to deliberately hold up the reconditioning of the *Leviathan* in the hope that the Boston Navy Yard might obtain this work through a questionable estimate.

That a bid from a navy yard is no more nor less than an estimate is evident from the following quotations from a letter written by Edwin Denby, Secretary of the Navy, to the *New York American* under date of November 8, 1921:

"A bid by a private firm is a guaranty of the performance of the work at a price named and within a time stipulated.

"A bid from a navy yard is the estimated cost of the work. If work is awarded a navy yard after an estimate, the actual cost of the work is charged, whether the same be greater than or less than the estimated cost. Estimates ordinarily run fairly close, say, within about 10 percent; but in a big reconditioning job where the actual amount of work necessary can only be revealed after opening up work and uncovering all defects, it is difficult to make an estimate that will fall within 10 percent of the actual cost.

"Furthermore, the stipulated time for performance of work for other departments of the Government must always be subject to the condition that urgent naval work shall take precedence even if such precedence causes failure to perform the other Government departments' work within the time stipulated.

"As the total cost of reconditioning the *Leviathan* will probably run somewhere between $6,000,000 and $8,000,000, it will be seen that an estimate submitted by a navy yard would not give the Shipping Board the exact information which they desire as to cost and time of performance of this work. The necessity for economy is so great that the authorities of the Shipping Board do not feel that they could take the chance of overrunning the estimated cost by possibly $500,000 or $600,000. They must have a guaranteed total expenditure."

The Secretary of the Navy might have gone even farther than this; he might have added that the Merchant Marine Act both in spirit and in letter directs the Shipping Board to get the Government out of the shipping business; he might have added that such work in a navy yard does not include overhead charges on the plant investment or insurance which must come out of the taxpayers' pockets and he might have added that the organization of a navy yard, while excellent for naval work, is not nearly so well adapted for merchant work.

It is true that it has been the practice of the navy yards to charge a certain overhead on private work, including most everything except plant investment and insurance, but labor organizations interested in navy yard work backed by the American Federation of Labor, have demanded that other than naval work be given to the navy yards in order to allow the continued employment of the men and that all overhead charges arising from the military functions of these establishments, as well as those arising from equipment made idle by past failure to keep it in production, be eliminated in figuring the costs.

It seems, therefore, that, in spite of the fact that there should be as many men employed whether a ship is repaired at a navy yard or a private plant, an effort is to be made to urge legislation to keep the Government in the shipping game. It is of vital importance to encourage private capital to invest in shipping and shipbuilding, but this will be a hopeless task if the Government, backed by the public treasury, is to compete against it.

We want an adequate American merchant marine and an efficient American Navy. To accomplish this, we must have shipyards and navy yards, but we must remember that ships are not built so that shipyards may have work nor are warships constructed so that navy yards may repair them. As the general welfare of our shipyards must depend on the success of the merchant marine so must the amount of work available for navy yards depend on the size of the navy. Special jobs in the navy yards can only hope to delay the final day of adjustment at the expense of the shipyards and the taxpayers. The navy yards are for the Navy and they should so remain.

The Naval Morale

They have served up the Navy on a silver platter as a sacrifice on the altar of Peace but no murmur of complaint has been made by the naval officers who have been trained to submit as well as to command. Our Navy with its splendid tradition has no finer example of the self restraint of its entire personnel than has been given during the last few months while the fate of its latest and most powerful ships has hung in the balance.

It is only human to consider selfish interests and these men have known full well that this great reduction in warships means far fewer opportunities for promotion. Yet they have not complained because they also have known that the continuation of the competitive building of armament means ruin and disaster to the world.

However, the stopping of competitive building does not mean that we are not to have a Navy that is reasonable in size. By the terms of the treaty we will still have 18 battleships, 316 destroyers, 35 cruisers, 147 submarines, 196 auxiliaries and 152 small vessels. In addition to this, a number of scout cruisers and aeroplane carriers will be added as the treaty provides for them. This is the size of a navy that the Disarmament Conference considered necessary to meet the minimum requirements for the safety of the United States.

To return to our subject, is the naval personnel which has been reduced to 6,129 commissioned officers and 96,300 enlisted men to be subjected to wholesale slaughter or are the ships that we are allowed to retain to be efficiently manned? If Congress is not satisfied with the drastic cut that has already been made and decides to lay up the remainder of the fleet or keep it in an undermanned condition, then an unjustified strain will be placed on the morale of the Navy which would amount to nothing less than criminal negligence in the present state of world civilization.

Why We Should Have a Subsidy

By "Old Scotch"

The greatest question before the American shipping public is still the proposal to devise some means whereby we can operate our immense merchant fleet, in being, successfully. All other questions are subordinated until we find the solution of how our American ships can be kept on the seas.

At this writing, early in February, the President has not made his expected visit to Congress for the purpose of addressing them on the subject of aids to the merchant marine, but there seems no doubt but that he will do so in the near future. The several committees of experts have made their reports on the various phases of the subject and everybody interested is ready for the initiative to be taken.

The enemies of the measure have started in to oppose it and are evidently paving the way for a vigorous campaign against it. Already editorials have appeared in certain daily newspapers opposing whatever form the proposed legislation may take. These "patriotic" effusions are so uniformly opposed to anything beneficial to the American merchant marine, that it is really quite amusing to observe the various lame excuses given for opposing this particular class of proposed legislation. To bolster up their views (probably made abroad) they have their various correspondents interview certain gentlemen who are opposed to anything in which they are not personally interested and quote at length their opinions as the voice of the people rising up in indignation against this approaching legislation to aid shipping, whatever it may be. In other words, they do not know anything about the subject, nor do they know what form of relief is to be asked for, but on general principles they are "agin" it.

Nevertheless and notwithstanding, some measure of relief for shipping is bound to pass and at this session of Congress, too. The reasons for such relief are so impelling, and will be presented so forcefully, that any of our national legislators who are not violently and unreasonably prejudiced can and probably will support it. There are so many viewpoints which can be taken on the whys and wherefores of this proposed legislation that regardless of party affiliations or local interests any member of the House or Senate can find it to the advantage of his constituency to support the measure.

Merchant Shipping a Means of National Defense

Let us consider it for this article solely as a matter of national defense—all parts of the country are vitally interested from that standpoint. The Limitation of Armaments Conference, now so happily terminated, has, by its agreement to limit the number of capital ships, made merchant shipping of double the importance that it was before. With a limited number of battleships, every large passenger or freight vessel becomes potentially a national asset for purposes of defense. While we are all in more or less accord as to the advisability of reducing competitive armaments, there are but few of us sufficiently idealistic and optimistic to think that all wars are over. Far from it, and particularly will we find it fallacious, if we do not from now on maintain a robust American merchant marine. With our war vessels reduced to the agreed minimum, if we allow our merchant vessels to disappear from the seas, we will be as helpless as a one-arm man in a street brawl, and the brawlers will know that the one-arm man has large sums of money in his pockets.

No matter in what form future warfare may develop, whether on land, on sea, or in the air, merchant shipping must necessarily be a vital element for the transportation of troops, supplies and munitions of whatever kind may be used. Even if this country is not directly involved, the warfare may be between countries upon whom, unless we keep up our own shipping, we have been forced to depend for ocean transportation. We only have to harken back to 1914 and 1915 to understand how such a condition may well arise and what serious consequences it could bring upon our whole business interests.

Notwithstanding the many beneficial international agreements entered into at the recent conference, we must not forget that the use of the submarine was very slightly curbed. Should we maintain but a very small merchant marine, a few energetic enemy "subs" could very quickly put it out of business.

Merchant Marine Naval Reserve Proposed

One proposal of combining our naval resources with our merchant fleet has already been made, and it is well worthy of the attention of our law makers. Briefly, the plan is that instead of cutting down our existing naval personnel, by summarily discharging about one-third of the commissioned officers and enlisted men, as is now being seriously considered by Congress, in order to reduce maintenance expenditures proportionate to the reduction in capital ships, it is proposed that they be placed in what would be termed a Merchant Marine Naval Reserve.

The proposal is to pay these officers and men half of their present naval salaries from appropriations for the national defense, providing they serve on merchant vessels and receive the other half of their pay from the shipowners or operators. This would accomplish a saving of about twenty-five millions of dollars in the annual naval appropriation and would make it unnecessary for Congress to appropriate money as a subsidy fund to shipowners, in order to overcome the differential between American wage rates and the wage rates of our competitors. This, it is estimated, would cost for an adequate American merchant marine, about twenty-five millions of dollars. The Government would by such a procedure save fifty millions of dollars annually and would not have lost any of its effective fighting strength, so far as trained naval personnel is concerned.

As the Navy must operate the merchant marine in time of war, it would by this method have a splendid trained personnel to operate merchant vessels in a very efficient manner, and thus avoid many of the sad experiences which we had during the past war. Some of our merchant crews during that period were composed of the worst bunch of foreign highbinders and bolshevists ever gathered together since the days of Captain Kidd and his "regular" pirates. The surest way, therefore, to make our merchant crews thoroughly American, with innate ideas of discipline and loyalty to our flag, is to adopt some such method as this.

Of course there would have to be limitations on the use of these young naval officers, as the transition from purely war duties to merchant duties could not be made over night. It has therefore been proposed that only naval officers who

are under thirty years of age be taken over, and that with the understanding that they be placed under trained merchant skippers, chief engineers and first mates for a period of five years, until "they know the value of a dollar and how to make it instead of spend it," as one well known shipping man recently expressed it.

One Hundred Percent American Crews

The merchant marine would be the gainer by injecting such an element of selected and well trained youngsters in it to replace all aliens. Of course no one would think of displacing that fine array of genuine Americans who have in the past five or six years taken up a seafaring life, but they unfortunately are not sufficient in number to man a real American merchant marine of the proper size to meet our demands both for trade and for national defense. With the addition of the naval contingent we would, in a few years, have a trained personnel in our merchant marine which would be second to none in the world, as it would then be truly "one hundred percent American."

As many of us can well remember, it was only as recently as the Spanish war when the Navy staff was manned by a heterogeneous collection of enlisted men almost of 57 varieties. One ship, and a flagship at that, which the writer knows of in particular, actually had representatives of 26 different nationalities in her crew of 350 men. One wag (American, of course) suggested that a sign "English spoken here" be posted on the berth deck. Now the Navy, according to the latest reports, is composed of over 99 percent American citizens, and its efficiency is as nearly perfect as it can be made. If reductions must be made in this well-trained force of men, what better place to put them than on our merchant vessels?

Our Merchant Marine Created for Commerce and National Defense

We must not forget, in this connection, that the Jones bill committed this country to a policy of maintaining a merchant marine adequate to its needs both for commerce and national defense. The necessity for our merchant marine to develop and maintain our commerce overseas has been plainly demonstrated by many able statesmen and writers. Not so much has been written as to its value and absolute necessity for our national defense and it has been the endeavor in this brief dissertation to point out some of the salient features along these lines.

Viewed as a strictly business proposition, there are some well meaning economists who might satisfy themselves that to subsidize or give preferential treatment to merchant shipping, as such, is not based on their ideas of logic. Unfortunately there are quite a number of followers of such theories who do not have the breadth of vision to see that a nation's shipping must not be weighed in the scales of economic suppositions. To any such, let them adopt their theories as they may on that ground, but in the light of past history (which is always the best precursor of what may happen in the future) let them not forget that the merchant marine must be maintained as an element of national defense, and a more important element at this time than ever before.

It has been clearly demonstrated that we cannot operate merchant ships in competition with our rivals, for the plain reason that our standards of wages and living are the highest in the world, and we just don't want to lower them for any part of our people, until we are compelled to do so. We find that we can overcome this difference in expense by the Government contributing from thirty to fifty millions a year to private shipping enterprise. It is necessary for our national safety that we keep up our merchant shipping, so let us pay out this money and not call it a SUBSIDY—call it a national defense fund, but make it available just as soon as possible, before we slip back to our pre-war state of unpreparedness.

Water-Borne Commerce Shows Marked Upward Trend

THE water-borne foreign trade of the United States showed marked improvement for the month of December, according to figures given out by the Shipping Board. Excluding bulk oil moved in tankers, the total overseas traffic increased 609,500 tons, or 21 percent over the November figures. Exports alone showed an increase of 32 percent. This is the first upward trend in our shipping figures since the coal movement in June.

The Shipping Board maintains statistics of the waterborne foreign trade of the United States measured in long tons weight and divided under three heads, the over-seas cargo movement, the bulk oil movement in tankers, and the Great Lakes movement.

The total imports decreased 9 percent and the total exports increased 12 percent compared with the previous month, but if compared with the same month in the previous year, there is shown a 6 percent loss in imports and a 40 percent loss in exports, or a total decrease in the year of 26 percent, or 2,400,000 tons.

The Great Lakes traffic, with the closing of the season, declined about 48 percent, from 1,409,190 tons in November, to 730,639 tons in December. November, with the influx of Canadian grain, marked the peak of the import movement, while August shows the peak of an export movement which included, during the year, more than two million tons of American grain. December imports were 610,456 tons, 37 percent less than November, and exports were 120,183 tons, 72 percent less than November. American vessels carried 96 percent of the imports, 70 percent of the exports and 92 percent of the total cargo tonnage.

Tanker cargoes in December aggregated 2,397,988 tons, an increase of 4 percent over November. Imports were 1,883,316 tons, two thousand and sixty-five tons less than November, and exports were 514,672 tons greater, an increase of nearly 22 percent over November. American vessels carried 86 percent of the imports, 34 percent of the exports and 75 percent of the total tanker cargo tonnage.

The important portion of our foreign commerce, that carried in overseas cargo vessels, increased from 2,900,000 tons in November to 3,500,000 tons in December, and marks the first gain in our overseas commerce since the flurry of May and June caused by the miners' strike in England. Further, this gain was entirely in the exports, as the imports fell off slightly. The total export overseas, exclusive of oil, amounted to 2,521,132 tons, or an increase of 32 percent over the previous month, although still 45 percent less than the export trade of the same month a year ago. Including both exports and imports, our overseas dry cargo trade in December was 21 percent above the previous month and 41 percent less than that of December, 1920. In this trade American ships carried 27 percent of the exports, 34 percent of the imports, and 29 percent of the total trade.

Handling of the George Washington Appreciated

APPRECIATION of the efficient and capable manner in which the *George Washington,* operated by the United States Lines for the Shipping Board, was handled on her recent trip from New York to Bremen during several days of one of the most severe storms that has ever been experienced on the North Atlantic Ocean is contained in resolutions received by the Shipping Board, signed by Alexander P. Moore, owner of the *Pittsburgh Leader;* Robert Goelet, Henry Kaufmann, Adolph Vogel and J. M. H. Lidgerwood.

The Shipping Subsidies of Japan and France

By Winthrop L. Marvin*

Two nations besides Great Britain—Japan and France—have made long and extensive use of shipping subsidies for the encouragement of their merchant marines. Postal subventions, general subsidies and even shipbuilding bounties have been practiced by these two countries for many years. How have they succeeded?

JAPAN was chiefly a nation of junks when in 1896, after her victorious war with China, she began to give vigorous national aid to her shipbuilding and navigation. There were then, it is true, a few Japanese ocean steamers, but they aggregated only a little over 100,000 gross tons—five years before the Chinese war produced its sudden need of transports, Japan had only thirteen ocean steamers of 27,700 gross tons. The war had brought an impressive object lesson to the Island Empire, and it had resolved never to be a shipless land again.

The Japanese government in 1896 frankly modeled its shipping acts on both British and French precedents. To its national ocean mail lines Japan, exactly as Great Britain had been doing since 1839, gave generous direct subsidies or subventions, and not content with this and realizing that it was not sufficient, Japan also provided bounties for the encouragement of shipbuilding and mileage subsidies for general shipping, exactly as France had done.

Shipbuilding in Japan was then a small, precarious industry. Most of the Japanese ocean vessels had been bought from Europe. The first Japanese shipbuilding bounty law, enacted in 1896 to be effective for fifteen years, gave 20 yen (about $10) per gross ton for the construction in Japan of seagoing ships of more than 1,000 tons gross register, and in addition a bounty of 5 yen ($2.50) for each indicated horsepower of machinery. Under this encouragement ocean steamers of increasing size began to be constructed, and Japan developed the excellent shipyards which for many years since have been producing not only her merchant vessels but her men-of-war.

Navigation Bounties for All Ocean-going Vessels

General navigation bounties based on French policy were provided in the acts of 1896 for all ocean-going vessels of the Japanese merchant marine—the rate being at so much per gross ton per hundred miles run, as in original French practice. For the further encouragement of native shipbuilding foreign-built vessels, except the very latest, not more than five years of age, were excluded from the benefits of these navigation subsidies.

In addition the Japanese government subsidized very liberally new regular passenger, mail and fast freight steamship services to Puget Sound, San Francisco and Australia, another line to Europe and subsequently a line to South America. This policy gave to Japan within a few years an excellent fleet of thoroughgoing liners and cargo steamers, and at the same time created highly efficient construction yards and an adequate force of naval architects, engineers and workmen. When Japan suddenly attacked Russia in 1904, the Japanese government was abundantly supplied with transports and auxiliary vessels to supplement its navy, and also reserve officers and men of the merchant service and admirable facilities for the reconditioning and repair of its battleships and cruisers. As a means of quickly providing a great merchant marine, invaluable in peace or war, the Japanese subsidy policy had proved wonderfully successful. Appropriations for this policy in the Imperial budget for the year ending March 31, 1909, included the following in yen (yen equals 50 cents):

	Yen
Shipbuilding bounties	1,995,400
Navigation bounties	3,483,955
Subsidy to European line	2,673,895
Subsidy to San Francisco line	1,013,880
Subsidy to Seattle line	654,030
Subsidy to Australian line	425,782
Subsidies to various lines to Korea, Dalny, China, and other Asiatic and domestic ports	2,118,713
Total	12,365,655

Subsidies Constantly Maintained

That is to say, in 1909 the Japanese government was expending upwards of $6,000,000 in subsidies and bounties for the encouragement of its shipbuilding and navigation—or about five times the total ocean mail disbursement of the United States. On one line of three ships to San Francisco in 1910 Japan was expending $1,340,000—in fact, making up its commercial deficit and sustaining three admirable ships of its naval reserve which could not possibly have lived without it. These three Japanese steamers, by the way, were at that time the fastest and most formidable auxiliary cruisers on the Pacific Ocean.

As Japan's merchant marine has steadily developed through the years, there have been changes in the details of legislation, but the principle of national aid by subsidy has been constantly maintained. After a considerable fleet of cargo steamers had been created, the navigation bounties to ships of this type were gradually discontinued, and the ships were left to rely on their low wage costs of operation. Japanese shipbuilding bounties are still in force, though suspended during the world war for the time being. The national steamship services like those to Europe and to the Pacific coast of the United States are still in receipt of subsidies that rank among the highest in the world. Here are the records of the marvelous growth of the Japanese merchant marine under a policy similar to that recommended for the American Congress:

Year	Tons
1895	301,101
1900	574,557
1905	873,552
1910	1,149,222
1914	1,708,386
1915	1,826,068
1916	1,847,453
1919	2,325,266
1920	2,995,878
1921	3,354,806

What subsidy has done for the Japanese merchant marine is one of the most significant events of history. With no such ocean-going traditions and no such commercial experience as the Americans, the Japanese before 1914 had far

*Vice-president and general manager of the American Steamship Owners' Association, New York.

outstripped us in the development of a modern overseas merchant fleet—because theirs had been a protected industry while ours had not been.

France, from whom Japan took her shipbuilding bounties and navigation subsidies, has made a long, brave effort to evolve a merchant shipping of high character. Originally, many years ago, France pursued a free ship policy of depending for her tonnage on ships from foreign yards. This free ship experiment, of course, proved to be a dismal failure, paralyzing French shipyards without adding any substantial new tonnage to the merchant marine. In fact, for years the entire French shipping amounted to only about 1,000,000 tons, coastwise and overseas tonnage both included.

French Adopt Subsidy Principle in 1881

In 1881 the French people, chagrined at long failure, resolved upon the adoption of a comprehensive system of construction and navigation bounties, and more liberal postal subsidies than had been paid before. In their zeal the French included sail vessels within the benefits of the law and at first provided a bounty for them that was actually more generous and effective than aid given to steamers. A larger subsidy to sail vessels than to steam craft was a manifest economic blunder which developed a beautiful sail fleet but did not symmetrically increase the merchant marine. The French subsidy law of 1881, amended in 1883, was still further amended in 1902 and again in 1906.

French subsidy and bounty laws, so frequently altered, have gradually become more efficient and productive. The French budget for 1908 provided 10,400,000 francs ($2,700,200) for shipbuilding bounties and 31,500,000 francs ($6,079,500) for general navigation and shipowners' subsidies. French shipping was in a relatively flourishing condition and gained markedly in tonnage, just before the outbreak of the great world war.

The backbone of the modern French mercantile marine consists of the two great postal steamship companies, the Compagnie Générale Transatlantique and the Messageries Maritimes. These are among the oldest and most famous of the overseas steamship companies of the world, and have been very liberally supported throughout the years by the French government and people. It is in the fleets of these two great companies that French maritime achievement is seen to the best advantage—great, fast steamers, admirably officered and manned. In 1909 the French government was paying a total amount of $13,423,737 in encouragement to its merchant marine, of which somewhat more than $5,000,000 was devoted to the postal subsidies.

Now Third Largest Shipping Nation

Those who speak of the French subsidy system as a failure are unaware of the real facts. There have been many defects of detail in French subsidy laws in the past, but these have gradually been eliminated and the French policy of national aid has proved more and more notably successful. There can be no gainsaying the official records of the recent growth of the French mercantile marine which from 1890 on are as follows:

Year	Tons
1890	1,045,102
1895	1,094,752
1900	1,350,562
1905	1,728,038
1910	1,882,280
1914	2,319,438
1915	2,285,728
1916	2,216,643
1919	2,233,631
1920	3,245,194
1921	3,652,249

Here are actual figures which speak far more eloquently than any irresponsible anti-subsidy propaganda. From a negligible factor in 1890, France has steadily advanced until she stands at present as one of the three greatest merchant shipping powers of the world—her tonnage in 1921 exceeding Japan's and placing her next only to Great Britain and the United States of America. Norway, with all her traditional talent for shipbuilding and navigation, has not of recent years succeeded in increasing her merchant tonnage as notably as has France, the Norwegian merchant marine in 1921 standing at 2,584,058 tons gross register, more than a million tons below the total of France. Of course, both France and Norway suffered terribly from the ravages of the German submarines.

Foreigners Fear an American Subsidy

Most of the assertions which we have been accustomed to hear in the United States, that the French subsidy policy was not productive, refer to the earlier and experimental period of French legislation. Those who have implicitly accepted these statements from overseas have simply fallen victims to interested propaganda. Foreigners who have marked well the amazing development of manufactures under a protective policy in the United States, live in mortal dread of the application of a protective policy to American shipbuilding and navigation. They are appalled at the prospect that such a policy in a few years might make the United States the greatest shipbuilding and navigating power in the world. Hence the publication and distribution of a vast library of misinformation on the subject, to muddle the minds of the American people.

The frequent assertion that France has spent millions in subsidy, with only the result that her merchant marine is as little as ever, is an example of the truth and accuracy of this kind of propagandist literature. Of course, it is a lie out of whole cloth, but it is astonishing how many American public men and editors have allowed themselves to be deceived by it without making any investigation of their own.

Both Japan and France have conspicuously succeeded in their shipping subsidy undertakings—Japan the more quickly and easily because she is an island empire, with a redundant population, rapidly developing her own industries and commerce. Indeed, her government has made the encouragement of shipping its chief, dominant thought for the past twenty years, while to France the development of her merchant marine has been an important, but not an all-pervading, thought. Yet of the two France is today the greater maritime power, measured by the tonnage of her merchant fleet.

Neither Japan nor France begins to have the resources of the United States for the creation and maintenance of an immense merchant trading tonnage. Our commerce is incomparably greater. So are our ports and seacoasts, our resources for shipbuilding, our historic fame for skilful navigation. Let us not forget that within the memory of many men now living our chief competitor, Britain, frankly acclaimed our shipowners, officers and seamen as the most efficient and successful men of their calling in the world. That was in the years when there was something like fair play for the American merchant flag on the long routes of ocean commerce. That fair play there has not been for a decade preceding, and almost six decades following, the Civil War.

Model Marine Insurance Law for District of Columbia Passed by House and Senate

Consideration of the bill providing for a model marine insurance law for the District of Columbia was begun in the House on February 13 and continued on February 15, when it was set aside for other business. The bill was passed by the House on February 22. It had previously been passed by the Senate.

Congress and Shipping Board Have Begun to Act

Leviathan Contract Awarded at Last—Shipping Board Appropriation Assured—Entire Government Fleet Offered for Sale

By Harold F. Lane

THE contract for the reconditioning of the *Leviathan* was awarded, at a special meeting of the Shipping Board on February 15, to the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., in spite of a vigorous campaign on the part of labor organizations, Massachusetts Congressmen and others to force the board to have the work done at the Boston Navy Yard.

The board stated that the approximate cost of placing the giant liner in commission would be $8,200,000. Of this amount $5,595,000 will be spent for general reconditioning and conversion of the vessel into an oil burner and $515,000 for repairs to machinery. Both of these contracts were awarded to the Newport News Shipbuilding and Dry Dock Company. Gimbel Brothers of New York were awarded the contract for the equipment of the steward's department and for a library, the price being $551,000.

Gibbs Brothers, engineers, of New York, were retained by the board to supervise the reconditioning of the ship, their fee being $182,000. William Francis Gibbs of this firm was formerly chief engineer in charge of construction for the International Mercantile Marine Company of New York but severed his connection with that corporation to join with his brother, Frank H. Gibbs, in forming a new company to supervise the work. They will employ a staff of assistants. In awarding this contract the board made a saving of $28,000 as the International Mercantile Marine Company was to receive the sum of $210,000 according to the terms of a contract it had with the board. This contract was recently cancelled by mutual consent.

The balance of the $8,200,000, namely $1,357,000 will be expended for moving the ship to the contractor's yard, insurance covering this removal, new anchors and chains, moving the vessel to dry dock, dry docking, trial trip, and maintenance and guarding of the ship for 14 months during reconditioning.

Work to Start Immediately

Work on the *Leviathan* will be started immediately and she will proceed at once under her own steam to the shipyard at Newport News. The contract was signed by Joseph W. Powell, president of the United States Shipping Board Emergency Fleet Corporation, and Homer Ferguson, president of the Newport News Shipbuilding and Dry Dock Company.

As soon as she has been reconditioned at the Virginia plant the *Leviathan* will be taken to the Boston Navy Yard where she will be dry-docked and her bottom scraped and painted.

At the time bids were asked for—last November—on this vessel the Secretary of the Navy stated that his department did not have an appropriation to prepare an estimate, did not have the facilities to carry out this type of work and could not submit a bid upon which a binding contract could be made. For these reasons the Navy did not figure on the work. Secretary Denby reaffirmed his position in a conference with Chairman Lasker of the Shipping Board on February 14.

The board issued a statement saying it was obliged to award the contract to the Newport News Shipbuilding and Dry Dock Company because:

1. February 15 had been fixed months ago as the last day when the bids put in by the competing contractors would remain open.

2. The bids were taken at the low dip of the market and undoubtedly if new bids were taken again a considerable increase in the estimates, probably more than a million dollars, would result.

3. If the matter were put over until the Navy could submit an estimate, which it has informed the board is not desirable or practicable, it would take that department at least 60 days in which to prepare an estimate, as it occupied that period of time for the successful contractor at a cost of $30,000 to make up its proposal. If the Navy therefore was to bid on this work now, it would mean the loss of the Spring and Summer trade in 1923, which in money would amount to more than a million dollars, which in addition to increased costs would greatly raise the total.

4. The Newport News Shipbuilding and Dry Dock Company were the lowest bidders.

The President, Chairman Wesley L. Jones of the Senate committee and Chairman William S. Greene of the House committee on merchant marine affairs have approved the action of the Shipping Board in awarding the contract to the Virginia corporation.

Yard Ready to Start Work

The Newport News Shipbuilding and Dry Dock Company, which recently reduced its forces, expects to take on 1,500 to 2,000 additional men to handle the *Leviathan* work, making a total of about 5,000. The company, in anticipation of the contract, started dredging a place alongside one of its piers early in February for the *Leviathan* to berth. Schedules for new fittings and equipment amounting to over $1,000,000 that are necessary for reconditioning the vessel have been prepared.

The necessity for making complete new plans and specifications directly from the ship, which was done at a cost of $250,000 after the Germans had demanded $1,000,000 for the plans, has made it possible to get a lump sum bid for the work, the first time on a reconditioning job of this magnitude, it is said. Usually work of this kind involves a large sum for extras, but because of the completeness of the specifications it was possible to get eight lump sum bids. Officials of the board consider that the expenditure of $250,000 on the plans will, therefore, save perhaps $2,000,000 in the total cost of doing the work.

The highest possible standards are to be adopted in the reconditioning. Entirely new electric lighting, heating and plumbing systems are to be installed and it is believed that the safety will be greatly increased by the plans for eliminating one-half of the watertight doors below the waterline.

All first-class cabins are to be equipped with telephones and it is expected that by the time the ship is ready for service in May, 1923, the art of wireless telephony will have made such advances that it will be possible to send and receive messages from the cabins to and from any part of the world. Chairman Lasker says the boat will be "the finest hotel in the world on land or sea."

Boston Navy Yard Wanted the Contract

Much pressure was brought to bear on the Shipping Board and the President to have the work done at Boston, particularly since the reductions in force that were made at the various navy yards, but the President has been adhering to the policy of "less government in business" and

moreover he took the position that the work would relieve just as much unemployment in one community as in another. The Mayor of Boston had been in Washington trying to influence the giving of the work to the Charlestown navy yard, the Massachusetts legislature had sent a memorial to Congress, the labor unions had been most active, and Representative Dallinger of Massachusetts had succeeded in securing the adoption by the House of an amendment to the appropriation bill for the Shipping Board and the Fleet Corporation which would require giving the navy yard an opportunity to estimate on the work. Senator Lodge of Massachusetts made an effort to have a similar amendment added in the Senate, but after he had failed to win support for it he accepted a substitute suggested by Senator Jones of Washington which contained the words "unless the President shall otherwise direct." The President had previously placed himself on record as opposed to giving the work to a navy yard in a letter to the Massachusetts Congressman who had asked that the work be given to the Boston yard.

With this amendment the bill was passed by the Senate on February 11, but as the bill still had to go to conference it was obvious that it could not become a law by February 15. The labor organizations had organized a lobbying committee of 30 members the night before, with President Samuel Gompers of the American Federation of Labor at its head, and each member called on three senators to urge them to vote for the "Lodge amendment." The modification suggested by Senator Jones enabled a good many of them to comply, who might otherwise not have done so. It was then impossible for the Shipping Board officials to say that they had any clear mandate from Congress, as it was obvious that the bill could not be passed by February 15, and they had previously indicated that in the absence of an expression by Congress the full responsibility would be upon the board for getting the work done in the most economical way.

I. M. M. Releases Board From Contract

Shortly before the announcement of the award the fact was made public that the International Mercantile Marine Company had reluctantly, at the urgent request of the Shipping Board, released the board from an option or contract entered into with former Chairman Payne, under which it was to supervise the reconditioning and later operate the ship. The board took the position that there was no binding contract but at its request the company agreed to waive the claim.

Shipping Board Appropriation Assured

The bill carrying the appropriations asked by the Shipping Board and the Emergency Fleet Corporation has been passed by both the House and the Senate without reduction of the amount, with various provisions restricting the expenditure of the funds which were included in amendments adopted by the House but not by the Senate, which required that the bill be sent to conference. The appropriation for the Fleet Corporation for the fiscal year 1923 as provided in the bill is $50,000,000 for operations and $50,000,000 for the settlement of claims, of which $30,000,000 is to be immediately available. A provision in the bill to make available the balance not used by July 1 of the $55,000,000 which under the previous appropriation bill may be used by the board out of the proceeds of the liquidation of assets was struck out on a point of order in the House but was left in in the Senate bill.

The appropriation for the Shipping Board proper is $459,000, including $20,000 for the investigation of foreign discrimination against vessels and shippers of the United States and for the investigation of transportation of immigrants in vessels of the Shipping Board.

Debate Brings Out Criticisms

In the House there was much debate and criticism of the board because of the salaries paid to officers and other transactions, but in the Senate the debate was principally on the question of the reconditioning of the *Leviathan*.

The House amendment proposed by Representative Dallinger of Massachusetts provided that no part of the appropriation shall be expended for the "purchase, acquirement, repair, or reconditioning of any vessel, commodity, article or thing," which at the time can be manufactured, produced, repaired or reconditioned for a less cost in any United States Government navy yard or arsenal, provided that this limitation shall only apply to vessels while in the harbors of the United States and all expenditures in connection with such work are to be considered in estimating the cost." An amendment proposed by Representative Graham of Illinois that not more than $1,000,000 shall be spent for the repair, reconditioning or rebuilding of any one ship was rejected after a long debate.

The bill as reported by the House committee provided that not more than 13 officers or employees, including seven attorneys, should be paid a salary in excess of $11,000. The last appropriation bill limited this number to six and the purpose of the bill was to allow the payment of $11,000 to seven attorneys. After a long debate, an amendment proposed by Representative Byrns of Tennessee was adopted, limiting the number of salaries in excess of $11,000 to six as at present and striking out the provision for seven attorneys. In the Senate, however, the committee proposal was adopted. An amendment limiting to $350,000 the amount to be expended as compensation for attorneys, regular or special, proposed by Representative Jones of Texas, was rejected in the House, as was one proposed by Representative Davis of Tennessee to reduce the appropriation for claims to $25,000,000 instead of $50,000,000.

Among the amendments adopted by the House was one by Representative Walsh of Massachusetts limiting the salaries to be paid by the board to $25,000 a year. A similar proposal was rejected, however, by the Senate. Another, proposed by Representative Black of Texas, provides that no claim shall be paid out of the amount provided unless the Shipping Board shall find that such claim grew out of an agreement, express or implied, entered into with the board or the Emergency Fleet Corporation or their legal representatives.

Publicity and Advertising Matter

An amendment proposed by Representative Walsh, which was adopted, provides that no part of the funds appropriated shall be expended "for the preparation, printing, publication or distribution of any bulletin, newspaper, magazine, journal or other periodical, or for services in connection therewith, not including, however, the preparation and printing of documents and reports authorized or required to be issued by law." This was struck out in the Senate.

An amendment proposed by Representative Byrnes of South Carolina to limit the expenditures for advertising to $500,000 a year was rejected after considerable debate, by a vote of 49 to 45.

Board Offers to Sell Entire Fleet

The United States Shipping Board, through the Emergency Fleet Corporation, has announced its intention of asking bids for the purchase of any or all of its steel cargo vessels, steel passenger and cargo vessels, steel tankers and the other vessels comprising its entire fleet, bids to be submitted by March 14. The ships are to be advertised for sale so that it will be possible to sell any of them promptly, if any offer is made, although it is expected that the best market will not be developed for the ships until the prospects for ship subsidy legislation are known more definitely. Purchasers who are willing to take a "gamble" on the prospect of a subsidy, however, it is said, will probably be able to purchase ships now at a better price than they could get by waiting.

The Fuel Question

By Robert E. Annin

In actual steamship operation the most expensive single item of cost is fuel; and toward economy in this regard there is a continuous struggle. The cheapness with which coal has been produced in the United Kingdom has been perhaps the largest factor in England's commercial supremacy, giving cheap fuel for her factories, cheap bunkers for her ships, a needed bulk export commodity to balance her inward traffic and a commanding control over the world's bunkering stations. Previous to the war Great Britain and her dependencies provided about 65 *percent of the bunker coal used and controlled about* 80 *percent of the bunkering stations. Today, however, through the regular processes of economic selection, oil has won the premier position as fuel for ship propulsion and in this article its advantages are discussed.*

IN fuel for sea-propulsion economy is possible in three directions. First there is the choice of the ship, which must be made in view of size and speed, as well as the nature of the service; the former choice depending largely upon the type of hull, engines and boilers. There follows the question of the *kind* of fuel to be used—coal or oil; and the *quality* of the fuel is of prime importance; for both vary in their thermal efficiency or power producing qualities (per unit of weight) according to their degree of conformation to certain established standards. Again comes the question of fuel *management* which is the responsibility of the engine department. The economical or wasteful use of fuel is a vital point in the records of the engine room.

Beyond this is the prevention of crooked practices by which the ship is overcharged for bunkers; or fuel is dishonestly removed from the ship and sold through collusion between the engine room and the shore—practices often covered up by doctoring the daily records of consumption. Such procedure applies also to provisions and other stores; and points another direction in which the selected personnel of a regular service gives a great advantage to established lines.

As to the choice between coal and oil for steam production at sea, the developments of the past few years seem conclusive wherever conditions approach equality.

Oil Versus Coal

In a preceding article, reference was made to the large proportion of oil-burning ships constructed in English yards during the year ending June 30 last. According to Lloyds, this amounted to 58 percent of the total deep sea tonnage built, and at that did not include ships converted from coal to oil during the same period. Considering the comparatively recent advent of oil as a power producer, so rapid a stride to a commanding position, against such an entrenched rival as coal, must be considered as closely approaching a demonstration of superior efficiency.

Ever since the use of steam began to be recognized as a substitute for animal energy, industrialism has been a constant, and progressive struggle for the economical production and application of power. The steam engine long preceded Watt. As early as 1698 Savery produced an engine for pumping mines, which worked, but was not a real success owing to its enormous fuel cost. Watt (1763) separated the condenser from the cylinder, thus conserving temperature in the latter, greatly reducing fuel cost; and so lifting the steam engine out of the experimental stage.

From then until the beginning of the present century coal was King. But with the discovery of certain grades of mineral oil in the southwestern portion of the United States, in Mexico, and the Malay Archipelago, a new fuel, more economical in production, transportation and application, became commercially available. Oil, by its success as a cheap power producer, has in the interim achieved such a position that it is difficult to see how it is to be displaced. Whether used for production of steam, or in internal combustion engines, no effective competition is in sight, unless vast progress shall be made in the transportation and storage of electrical energy produced by water power.

For reasons which are not far to seek, in every industry where conditions have been approximately even fuel oil has steadily won its way. Compared with coal its efficiency is about three to two—that is two tons of oil will produce the same energy as three tons of coal. There are claims that a result of two to one has been attained, which is possibly true under ideal conditions of oil use. For locomotive use an English railway claimed a test result of slightly better than two to one. Impartial judgment, however, must regard the former comparison as a safer working basis. Hence on a basis of first cost it would appear that whenever the price per ton of coal is two-thirds of the price of oil the first cost of the power unit will be the same whichever fuel is used.

Special Advantages of Oil Fuel

But oil has special advantages beyond its thermal efficiency. It is more easily and cheaply produced, loaded, unloaded and transported. It is practically self feeding, while coal must be painfully and expensively "stoked." It leaves no ashes or clinkers which must be re-handled and disposed of. All these are vital factors entering into fuel cost.

For land uses, such as railways and factories the result has been a progressive displacement of coal by oil wherever the point of consumption was not too far removed from the source of oil supply. Previous to the war, and under a regime of low ocean freights, even Great Britain, with no native oil and with her abundant and cheaply worked coal, was perceptibly swinging toward the use of fuel oil. In that period two large English railways—the Great Eastern, and the London, Brighton and South Coast—installed oil burning apparatus on their locomotives; the advantage, even over coal produced at their own doors, being then decisive. With the swift advance, not only in first cost but especially in ocean freights which followed, conditions compelled a return to coal until a more normal relation between the two should be established. But wherever fuel oil is available its commercial progress as a power producer has been steady and continuous.

For sea use the advantages of oil are accentuated by two considerations which cannot apply (at least, in equal degree) to railways or factories. The latter must, within certain narrow limits, stand the waste of bringing fuel from the source of supply to point of demand. The deep-sea steamer owing to her mobility can and does save a large portion of this waste. Her fuel expense is an enormous proportion of operating cost and she will bunker where bunkering is cheapest.

With the spread of oil stations over the maritime map, and the growth of cheap transport in tankers the advantage

to the lines which have terminals near any oil fields, or to tramps which accept business all over the world, is obvious. They can obtain at a minimum cost that which constitutes their most expensive single item of operation; and can often bunker "for the round" with double advantage.

Gain in Cargo Carrying Capacity

This suggests a second special advantage which steamers find in the use of this class of fuel. If a vessel of 6,000 tons capacity uses 1,500 of this for fuel and stores, she has 4,500 tons capacity left for revenue producing cargo. But if she uses but 1,100 tons for fuel and stores, her potential revenue capacity is increased by 400 tons. Further, apart from dead-weight lift, coal will occupy a space of about 42 cubic feet per ton, which otherwise would be available for cargo; while oil can be placed in ballast tanks (or double bottoms) where it will utilize room which would otherwise be wasted, and leave a corresponding space for stowage of cargo.

Clearly this decision as to oil or coal must regard two main factors.

1. The relative costs per ton, of each, *"under the boiler."*
2. The revenue value of space and lift capacity released by the smaller bulk and weight of the oil.

The latter of course will vary with prevailing rates and market conditions. If cargo is so scarce that full capacity cannot be utilized, this factor may not influence the calculation. Otherwise it must, and frequently does, prove decisive when the price of oil is greatly higher than that of coal.

Reduction in Personnel and Betterment of Working Conditions

Again, the reduction in *personnel* which oil permits is not only important as reducing expense for pay and subsistence but should be welcomed as doing away with that imitation of perdition, the old-fashioned stoke hole. None who have not seen it can have any conception of its horrors; and probably no one can appreciate the suffering which it causes unless he has had personal experience. From the humanitarian point of view alone, therefore, the steady trend toward oil fuel is a subject for congratulation. Anything that tends to lighten the lot of the merchant sailor (none too bright at best) should be welcomed.

To return to the commercial side. It is far cheaper and cleaner to put oil into tanks through a pipe than to load and trim coal into bunkers by dumping and shovelling. The saving of a steamer's time also is of great importance and constitutes an important economy in itself. For bunkering at sea (as in the case of warships, or for relief of a vessel short of fuel) there is no comparison. Coaling at sea is impossible except under favorable conditions owing to obvious dangers. But sea transfer of oil has been easily and safely accomplished through flexible tubes in quite heavy weather.

Costs of Coal and Oil Compared

If a comparison be made as to relative expense of coal and oil on any given ship the compelling reasons which give preference to the latter can be seen at a glance.

If a cargo ship can make a given voyage complete in forty days on 1,500 tons of coal, or 1,000 tons of oil, carrying a cargo of grain at 25 cents per 100 pounds, her expense of fuel and stoking would be about as follows, (with oil 50 percent above coal in price):

Coal

Cost—1,500 tons coal @ $5.00 per ton......	$7,500.00
Wages and subsistence, 9 stokers, 40 days @ $1.85 per day	666.00
Loss in gross revenue, 1,500 tons @ $5.60...	8,400.00
	$16,566.00

Oil

1,000 tons oil @ $7.50 per ton	$7,500.00
Wages and subsistence, 3 fire tenders, 40 days @ $1.85	222.00
Loss in gross revenue 1,000 tons @ $5.60 per ton	5,600.00
	$13,322.00

Here is a direct saving of over $3,200, or say $80 per day. Counting 300 days as the steamer's active year, the direct gain would be $24,000, without counting the saving in bunkering and gain in turn-around.

This is a simple comparison for a small cargo steamer and the saving, while material, will not compare in amount with larger and swifter freighters, to say nothing of large express passenger liners. So far as the latter are concerned oil seems on the point of monopolizing the field; new construction running almost entirely to oil, while coal burners already in service are being rapidly converted.

Savings Effected on the Olympic As An Oil Burner

The latest of these, concerning which details are available, is the White Star steamer *Olympic,* the largest British built passenger ship afloat.

The daily coal consumption of the *Olympic* was about 900 tons. Of oil she burns 600 tons per day, making a saving of say 2,000 tons on her eastward voyage, or 4,000 tons on a round trip.

As a coal burner the *Olympic* carried 246 firemen, working under almost intolerable conditions. Under oil, 60 men attend to the burners under healthy and comfortable conditions. This means economy in human lives. Stokers under the old system were constantly collapsing, frequently under physician's care, and as a class were driven to dissipation, and often to suicide, in the vain effort to forget their miseries.

As to expense, the wages and subsistence of 186 men (say $4,000 on an 18-day round trip) are eliminated—an annual saving (counting 300 days' service) of about $70,000—even under the English scale and with sterling at a discount. But this is not all. The *Olympic* required about 9,600 hours' labor for coaling, and everything had to give place to this vital operation. At that it took between four and five days. She can now oil in eight hours with the labor of ten men, (80 hours' labor) without dust or dirt, and without interfering with any other work. It is merely a matter of pumping from a barge to the ship's tanks. The ship's tanks carry about 7,500 tons and, owing to reduction in quantity and compactness of stowage, the space saved is released for uses producing or directly tributary to revenue.

Economies Compel Use of Oil on Liners

All in all it is obvious that the new liners are being equipped with oil apparatus, and that old ones are being rapidly converted because the resultant economies are simply compelling. Even British owners, who have no home supply of oil and enormous supplies of cheap coal, realize that they cannot meet oil competition with coal. Among the large liners converted to oil are (in addition to the *Olympic*) the *Aquitania, Mauretania* and *Berengaria* of the Cunard Line; and, of new express passenger steamers now building, it is said that practically all are designed for oil. The *Scythia* and *Caledonia* are examples.

It therefore appears that oil has won the premier position through the regular processes of economic selection.

So much for the steamer, on which the test between the two fuels has been chiefly made. When, and if, the internal combustion engine shall supplant the steam engine for sea propulsion (a condition which appears probable) oil seems likely to hold the entire field. For the internal combustion engine can beat the oil burning steamer as badly as the latter has beaten her coal burning rival.

The innate conservatism of the trade has made it cautious in accepting the motorship as a proved success but the results of continuous demonstration must ere long be generally conceded. The motorship appears to loom up as the ocean vehicle of the future.

Growing Importance of the Motorship

It is not necessary to go into more figures. It is enough to say that the motorship, by using about one-third the quantity of oil, can achieve the same speed as an oil burning steamer of equal size. Without going fully into details of various well established records the history of a Swedish motorship (the *Stureholm*) may be quoted.

The ship is of 7,800 tons deadweight capacity and when bunkered for 10,000 miles has a net cargo capacity of 7,200 tons—600 tons only being occupied by fuel and stores. Three consecutive voyages showed an average speed of just under ten knots on a daily consumption of fuel oil of 10¼ tons. An oil burning steamer of the same capacity and speed would be doing well to get off with 35 tons of oil per diem, and her cargo capacity would be reduced, not by 600 tons but by at least 1,700 tons, to take care of fuel and stores.

Not that the internal combustion engine has yet reached a point of development where the road lies straight and clear before it. Expense of original installation, weight, excessive pressures and temperatures are all handicaps at the present stage; and the success thus far has been achieved in spite of these drawbacks.

Sir Owen Phillips (himself an owner of motorships) expresses the belief that the internal combustion engine, as we know it today, will not eventually prove able to hold the field; but that engineers will evolve something giving double the power for half the weight and size.

Economy in the Use of Oil Imperative

That the utmost economy in the use of the world's oil supply is imperative is the gospel preached by all whose opinions on this point are entitled to consideration.

Considering its constantly widening use for power and light and the fact that as a lubricant there is no substitute for mineral oil, estimates that the world's supply can last only thirty to fifty years are disquieting. But this is a far cry. The need of saving every dollar on operation is an immediate and imperative need of the shipowner of today. Fuel is his greatest and most important item. Therefore the important point for the moment is this.

In view of the demonstrated economy of oil as an ocean fuel, coal can hardly come back to its old supremacy until, and unless, the price difference in its favor shall be sufficient to offset the superior economy and efficiency of its rival. This condition may arise whenever from reduction of supply or increase of demand the first cost of oil shall be raised to a point which shall neutralize its advantages in other respects. No such situation is now in sight.

Supremacy of Oil Not Menaced

Fuel oil is really a by-product in the production of gasolene, naphtha, benzine and the other products which utilize the more volatile elements of the crude. With the immense increase of demand for these, the production of fuel oil must continue at a high rate under present conditions, even though steamers are lying idle in every great port of every maritime nation. The United States Shipping Board (for instance) is said to have about a thousand steamers laid up; while the Clyde and Forth are lined with dead tonnage.

As long as this continues oil is likely to be an even fiercer competitor of coal than in the past. With continued production and slack demand the prospects are for continued low and even lower prices.

For a present comparison, good bunker coal is now quoted at 32/6 per ton (say $7.15) at Dartmouth, England. At Hampton Roads the price is about $4.75, plus trimming in (say 30 cents per ton). At New York similar quality is obtainable at about $5.50, to which the cost of trimming must be added (say 60 cents) making the cost (trimmed in) $6.10 per ton.

At this level (New York) fuel oil at $9.00 per ton would involve no larger original outlay than coal, and all the incidental savings would be net. In view of the latter (and varying of course with the individual ship as well as other conditions) oil would have to go to 2½ to 3 times the per ton cost of coal before these advantages would be neutralized.

Should the present situation persist, it would not be surprising if the per ton price of fuel oil should crowd down much nearer to the price of coal than it has ever been before. The inevitable result on the fuel question is too obvious to require comment.

Shipping Board Seeks Cancellation of Contracts With Japanese Steamship Lines

THE preferential traffic contracts between the Chicago, Milwaukee & St. Paul and the Great Northern and Japanese steamship lines, covering export and import traffic to and from the Orient, which the Shipping Board is insisting that the railroads abrogate in order to give Shipping Board vessels a chance for a share in the traffic, were the subject of an informal conference at the Shipping Board offices on February 2 attended by Chairman Lasker and Commissioners Thompson and Lissner of the Shipping Board, Chairman McChord and Commissioners Campbell and Potter of the Interstate Commerce Commission, Ralph Budd, president of the Great Northern, H. E. Byram, president, and R. M. Calkins, vice-president, of the Chicago, Milwaukee & St. Paul, and representatives of the Seattle Chamber of Commerce.

The Shipping Board reaffirmed its position that all preferential contracts between railroads and foreign steamship companies must be abrogated and stated that it could not enter into a contract with the rail lines to take the place of the foreign contracts. The railroad officers expressed their desire to aid the American merchant marine but reaffirmed their previous position that the abrogation of the contracts would only deprive them of revenue with no assurance that the business would go to the American boats, because of the control of a large part of the traffic by the Japanese soliciting agencies and the probability that the contracts would be transferred to Canadian lines.

It is understood that Mr. Budd proposed as a compromise that the contracts be abrogated and that the road agree to turn over to the Shipping Board vessels one-half of the unrouted traffic, giving the other half to Japanese lines in return for the business which they can give to the road. Commissioner Potter is said to have taken the position that the railroad officers would not be warranted in voluntarily giving up the contracts and thereby sacrificing their revenues. Members of the board claim that they have legal authority to compel the cancellation of the contracts but have preferred to try to persuade the roads to cancel them. The railroad representatives were to meet again with members of the board on March 1 with a view to giving their final answer at that time.

The executive committee of the Tacoma Chamber of Commerce has sent a telegram to the Shipping Board in which it "views with alarm" the reported insistence of the board on the abrogation of the traffic contracts between the Chicago, Milwaukee and St. Paul and the Great Northern railroads and Japanese steamship lines.

The New Uniform Export Bill of Lading

Affects Property Transported by Rail and Ship from United States to Points in Non-Adjacent Foreign Countries

By Waldon Fawcett

POSTPONED for one month at the request of the carriers, there will become effective on March 15 a new export bill of lading prescribed by the Interstate Commerce Commission. This is the culmination of a movement initiated more than a year ago. Representations on the subject have been made to the Interstate Commerce Commission by various shipping interests and whereas the rules and regulations prescribing the form of the new through export bill of lading do not fully meet the approval of all interested parties there is reason to believe that the plan worked out at Washington is a fairly satisfactory solution in behalf of the standardization which is admittedly desirable.

The new through export bill of lading is designed for issuance by carriers subject to the Interstate Commerce Act for application to the transportation of property, in connection with ocean carriers whose vessels are registered under the laws of the United States, from points in the United States designated under the provisions of Section 25 of the Interstate Commerce Act to points in non-adjacent foreign countries. In due course, an order will be promulgated by the Interstate Commerce Commission designating points on the lines of carriers enumerated at which information relative to the handling of export shipments by common carriers by water in foreign commerce shall be maintained and at which will be issued through bills of lading in connection with ocean carriers whose vessels are registered under the United States laws.

In ordinary practice it is customary for carriers to furnish bills of lading in connection with transportation over their lines, although large shippers, as a matter of convenience, frequently provide their own. In Paragraph 11 of Section 20 of the Interstate Commerce Act it is specifically provided that any carrier receiving property for transportation "shall issue a receipt or bill of lading therefor." Confirming this obligation the Supreme Court of the United States said in the case of Atchison, Topeka and Santa Fe Railway Company versus United States: "Whatever transportation service or facility the law requires the carrier to supply they have the right to furnish." In this same connection the Commission has assumed that a carrier could refuse to use a bill of lading tendered by a shipper which was of an unusual size or style or did not correspond with the terms of the lawfully published and filed bill.

Reasons for Uniform Bill of Lading

The investigation by the Interstate Commerce Commission which led up to the promulgation of the new export bill of lading was inspired to a considerable extent by widespread expressions of dissatisfaction with the conditions heretofore existing. In the course of a recent hearing before the Merchant Marine Committee of the United States House of Representatives on the subject of theft, pilferage, non-delivery, breakage, etc., in import and export shipments there was, on the part of a number of witnesses, severe criticism of conditions governing bills of lading. At that hearing ocean carriers and especially the United States Shipping Board were accused of putting in their bills of lading provisions exempting them from nearly every sort of liability.

C. E. Dobson, managing director of the Southern Lumber Exporters' Association, declared that almost every ship operator has his own bill of lading and that no two of them are alike. Furthermore, he declared that they were changed from time to time. His comment was that, if the Shipping Board would prescribe a standard bill of lading for all its operators and use a special form for each of the principal commodities, eliminating the "excess verbiage" and "untenable provisions," it would be a great source of relief to shippers. Frank C. Overton, president of the National Association of Waste Material Dealers, ventured to hope that some day the nation would have a standard bill of lading, worded in accordance with the law and free from individual and arbitrary clauses. He particularly attacked the practice whereby a steamship company stamps on its bill of lading a clause in effect as follows: "Steamer not responsible for marks nor for numbers of bales and broken bales or short weight on account of spilling or breaking of bands during the transfer."

Multiplicity of Reservations Objectionable

Various commercial organizations have charged before the Congressional committee that, under stress of war-time transportation conditions, various shipping companies have inserted in their bills of lading reservations that are in open conflict with the Harter Act, approved February 13, 1893. This is the statute which declares to be null, void and of no effect any words or clauses inserted in bills of lading designed to relieve the shipping interest from liability for loss or damage arising from negligence, fault or failure in proper loading, stowage, care, delivery, etc. Spokesmen for the organization of shippers and receivers of goods urged that Congress, in the interest of avoidance of misunderstandings, exert influence to induce the steamship companies to adopt a standard form of bill of lading. Or, if, because of varying port conditions in certain countries it be not practicable to concentrate on one standard form, then, as an alternative, there should be several standard forms adopted designed to meet local conditions.

In the recent representations at the Capitol with respect to the rights that should be guaranteed to the patrons of ocean tonnage, it has been emphasized that whereas every shipper and consignee is not posted as to his legal rights under a bill of lading, nevertheless an ocean bill of lading is supposed by the average merchant to be a negotiable document. He accepts drafts and draws drafts with an ocean bill of lading as security, and, if the supposed obligations of such a bill of lading are not fulfilled, there is proportionate embarrassment to the shipper or receiver of goods who has placed implicit faith in the document. One argument put forth at Washington was that there is as much reason for a standard bill of lading applicable to foreign commerce as for a standard form of insurance policy such as is now in use in the United States.

At one of the sessions of the Congressional Committee on Merchant Marine there was sharp debate on the question whether steamship companies had, in recent years, with unwarrantable frequency and without proper notice changed their bills of lading. Friends of the shipping companies on the committee contended that diligent inquiry showed that no steamship companies have changed their forms of bills of lading in the last three years. The antagonists were not prepared to say that the printed forms had been altered but made the point that in recent years there has been an increase in the number of rubber stamp imprints placed on bills of

lading, such rubber stamp surcharges constituting, in their judgment, changes in the contracts.

Difficult to Interpret

Critical fire was also centered, in the course of the recent discussions at Washington, on the alleged complexity of bills of lading. It was charged that the complexity of the bills in use is increasing rather than diminishing and that there are incorporated a large number of clauses printed in very small type and difficult to interpret. In the course of remarks at the Capitol, Mr. Charles E. Herrick, representing the Institute of American Meat Packers, took the ground that a complicated bill of lading that attempts to defy the Harter Act really injures the shipping interests in that it discourages newcomers in the export field. He recounted that there are many beginners in export trade, located at inland points, who are not versed in the Harter Act and no more are their attorneys. Such persons are apt to accept as gospel all the exemptions that a shipping interest may write into a bill of lading. The shipper, thus confronted, is apt to swallow his loss, but he is also likely to abandon all further effort to cultivate export trade.

In the discussions in Congressional committee much has been made by spokesmen for inland shippers of the difficulties of procuring ocean bills of lading at interior points. Shippers in the interior have testified that they have repeatedly asked for copies of the ocean bills of lading that were to govern particular contracts and have been as often told that these cannot be furnished because the local transportation officials profess ignorance of what form of bill of lading is to be used when the goods reach the seaboard. The shipper feels therefore that he is compelled to accept a contract the terms of which he does not know and cannot know. The interior shippers demanded that there be some provision of law that the freight contract on a shipment from the interior shall govern the terms of the bill of lading rather than be governed by a bill of lading issued subsequent to the receipt of the goods on board the ocean carrier and when it is, of course, too late for the shipper to withdraw them.

Shipping Executives Believe New Bill Will Eliminate Friction

Representatives of the ocean carriers, notably Mr. F. A. Ryan of the International Mercantile Marine Company and J. E. Waldorf of Chicago, have taken issue in Congressional conference with the interior shippers who complained of inability to obtain copies of ocean bills of lading. It was insisted that a shipper located, say in Chicago, should have every facility to ascertain details as to bills of lading inasmuch as the Chicago agents of the shipping companies have on file not only copies of the ocean bills of lading but copies of the connecting line bills. Mr. Ryan stated that, if an interior shipper made a shipment on a through bill of lading, his through bill would provide that it was subject to all the terms and conditions of the local bill of lading in use at the time that the shipment was made. This, he thought, would automatically mean that the date of the through bill of lading would govern the conditions of the local bill of lading which are in force on the day on which the through bill of lading is signed. The shipping executives have further stated in recent conversations with leaders of Congress that they have hopes that all friction and resentment on the part of shippers will be eliminated by the new through bill of lading which is presented by the Interstate Commerce Commission and the form of which was carefully gone over by committees of various trade associations as well as by committees representing the steamship lines before it was submitted to the Commerce Commission.

The present move on the part of the Interstate Commerce Commission constitutes a second effort on the part of that institution to secure the acceptance of uniform bills of lading. On April 14, 1919, the Commission prescribed a uniform export bill of lading and likewise a uniform domestic bill of lading. Upon petition of interested parties this issue was enjoined by the district court of the United States for the southern district of New York, three judges sitting as the statute provided. The majority opinion of the court held that the Commission had no authority to prescribe bills of lading for either domestic or export traffic. An appeal was taken to the Supreme Court which held that the passage of the transportation act of 1920 made the case a moot one and reversed the order of the district court. The district court was directed to dismiss the petition but without prejudice to the rights of the complainants to assail in the future any order that the Commission might make prescribing bills of lading after the enactment of the new legislation.

Transportation Act Makes Standardization Possible

The amendment of the Interstate Commerce Act by the Transportation Act of 1920 conferred upon the Commission authority to make rules and regulations prescribing the form of a through bill of lading. Without loss of time the Commission took steps to bring about the contemplated standardization. Railway carriers and shipping interests were directed to confer with the object of drafting a uniform bill of lading and the Commission made arrangements to distribute 500 copies of the tentative bill to export shippers and other interested parties in order that suggestions and objections might be obtained and there be worked out a bill reasonably satisfactory to all the interests involved.

Not without considerable opposition did the Interstate Commerce Commission proceed with its project. A number of the rail carriers, particularly those in the eastern part of the United States, challenged the power of the Commission to do more than prescribe the "form" as distinguished from the substance of the bill of lading. And counsel for American ocean carriers operating in foreign commerce on the Atlantic Ocean made clear their belief that the Interstate body had no power to prescribe any condition applicable to them without their consent. A representative of the Shipping Board who was present at the hearings on the subject conducted by the Commission likewise voiced the belief that the Commission has no jurisdiction over water carriers. The Interstate Commerce Commission has insisted, through it all, that inasmuch as the act to regulate commerce specifically requires carriers to issue bills of lading it has unquestionably power to prescribe as to the issuance, form and substance of bills of lading. Incidentally the Commission called attention to the fact that the rules and regulations constituting the forms of bills of lading affect the value of the service rendered to the shipper or consignee.

Convinced that it was the intent of Congress to require a uniform through export bill of lading and to have the terms prescribed by the Interstate Commerce Commission the latter proceeded with its task and to that end considered forms laid before it by numerous interests such as the prominent carriers, the National Industrial Traffic League, etc. The forms placed in nomination showed wide diversity and sharp variations in the wording of the embodied provisions. In the drafts put forward by shippers there was sought the benefit of full common-carrier liability from the time a shipment is delivered to the initial rail carrier for transportation until it is delivered to the consignee or his order at destination. Carriers, on the other hand, have naturally sought to restrict their liability to what they account reasonable limits.

Provisions of New Bill of Lading

With this ample fund of suggestions as a working basis the Interstate Commerce Commission evolved the new uni-

form bill which provides in effect that the shipment involved is subject to the terms and conditions of the local form bill of lading not inconsistent therewith. Certain physical features of the new bill will presumably meet with general approval inasmuch as there was substantial unanimity of demand for them on the part of both shippers and carriers. For example, there is provision of a bill of lading of a width convenient for use in an ordinary typewriter. Also to be cited is the stipulation of a form which permits all the printed matter to appear on the face of the sheet. This is a minor detail that is important because the number of copies which must be made in a set of export bills of lading is so large that it is desirable to use thin paper. No requirements have been made as to the size of type or color of paper.

Such has been the demand for specimens of the uniform through export bill of lading that the supply of the Interstate Commerce Commission has been exhausted. Copies can be obtained, however, upon payment of 5 cents each by addressing the Superintendent of Documents, Washington, D. C., specifying I. C. C. 7230 (No. 4844). The Contract Terms and Conditions attached to the new standard form make a rather voluminous document, subdivided into three sections. Part I covers the service of transportation until delivery at the port of embarkation. Part II deals with the service after delivery at the port first mentioned and until delivery at the port mentioned second—the port of debarkation. Part III is with respect to service after delivery at the port second mentioned and until delivery at ultimate destination, if destined beyond that port. The form has been prepared with due recognition on the part of the Interstate Commerce Commission of the limitations upon its jurisdiction over the ocean carriers.

This limitation is reflected in the disposition of some of the requests made by shippers. For example, the shippers urged that provision be made specially at a number of places in the bill of lading for notice to the shipper or consignee, or both, of changes which would otherwise be unknown to them, such as change in vessel. Most of the railroad interests are represented as not objecting to giving such notice, but, on this count, the Commission came up against a stone wall in the form of objection by the ocean carriers, exception being taken to the plan on the score of the clerical labor that would be involved in the case of shipments transported in a vessel other than that for which they were originally intended. The new through export bill of lading stops short, in certain other respects, of the desires of shippers at inland points because the Interstate Commerce Commission holds that the Cummins amendment, so called, does not apply to transportation from a point in the United States to a point in a non-adjacent foreign country.

In connection with the order of the Commerce Commission anent the new bill of lading, the Commission has disapproved a number of requests that have been received for permission to use old bills of lading or forms with no conditions printed thereon. The Commission feels that the use of makeshift bills would occasion much confusion in banking circles and among persons not dealing constantly with bills of lading. Moreover with uniform bills of lading in use throughout the country there will be little need for resort to irregular bills.

Pacific Coast Pool Discussed With President and Shipping Board

THE committee representing the various ports on the Pacific Coast, which has been working on a tentative plan for the acquisition of the combination passenger ships owned by the Government and operated in the Pacific, came to Washington on February 8, called on President Harding, and subsequently met with Chairman Lasker and the Shipping Board.

President Harding told the comittee that nothing concerned him more in domestic legislation than providing proper aids to establish an American merchant marine, and that it was one of his earnest hopes to see such aids provided. The President bespoke his deep interest in the formation of a company, the stock of which should be popularly owned by the people of all the Pacific Coast, for the development of the American merchant marine in the Pacific, with the hope of using the united assets of all to develop each port in the interest of the whole.

Chairman Lasker reviewed the needs of the United States on the Pacific Ocean, and pointed out that if ruinous competition prevailed between ports and companies there would not be that opportunity for the development of the American flag in shipping in the East that there would be through a popularly owned company, uniting all the ports of the Pacific Coast, thus cutting down overheads, which might make it possible for some ports to operate ships of certain types, the trade for which otherwise could not be developed.

The Shipping Board made no basis of proposal as to the price at which it held its combination passenger-and-cargo ships, but did stress that, in line with the Jones Act, it was its duty to make sure that the ships passed into private hands at the earliest moment compatible with the Government receiving a proper price. Until the President has delivered his address on government aid to private shipping to Congress, and Congress has taken action on same, the Board did not feel in a position to name a price. Immediately after Congress has expressed its will on merchant marine legislation, the Shipping Board desires to dispose of its Far Eastern passenger ships, feeling that through private operation the trade with the Orient can be much better developed than through Government operation. On behalf of the Board, Mr. Lasker asked the committee to bring about agreements in principle that would iron out the difference between competing ports and make the formation of such a company possible at that time.

Mr. Lasker made it plain that there was nothing in the suggested company that precluded any and all ports and all individuals purchasing any cargo ships desired, on the identical price and terms that any company, including the proposed one, could obtain. Mr. Lasker also pointed out that if a higher bid for the passenger ships other than the bid of the contemplated company was received, the higher bidder would, of course, obtain the ships; but he expressed the fear that unless such a company as contemplated was brought about, there might be no group strong enough to acquire the vessels, and therefore it became the duty of the Shipping Board to attempt to create a customer if none existed. In the creation of such a customer however the Shipping Board could only contemplate one that represented all the people of the Pacific Coast organized in the national interest.

The representatives of the coast ports were unanimous and enthusiastic in subscribing to the Shipping Board's belief that a company such as is proposed was essential for the country, for the Pacific Coast, and to carry out the purposes of the Jones Act. The only reservations were that each port should be free to reach its maximum development, and that the parent company should be so formed as to protect the interest of each port. The committee felt sure that this could be achieved. The committee stressed that while any new company that was formed desired to pay all that the ships were worth, any purchase would have to be based on the ships being acquired at a price that made proper earnings possible, if capital was to be attracted.

Developments in Marine Insurance

Standard Open Policy Drafted—Marine Business Picking Up—Oil Storage Hazards—Cleaning Tanks by Rule—Shipowners' Liability in the Courts—Proposed Lloyds' Legislation

By "Bordereaux"

AN important forward step has been taken by the American Institute of Marine Underwriters in endorsing the report of a special committee, recently submitted, on the much-discussed subject of a standard open cargo policy form. This is the reform that the banks have been clamoring for, that the decision of the English High Court of Justice necessitated, if the time-honored insurance certificate were not to lose caste altogether, and which a large number of progressive underwriting offices have been agitating for. To secure it there has been a great deal of hard work done for nearly a year by the special committee of the Institute, and now that it is finally achieved there is a rather disconcerting suspicion that the powerful brokers may bar its general adoption—such, unfortunately, is the influence of "big brokerage" in these United States. The banks will, undoubtedly, welcome it; their association has it under consideration.

This piece of real constructive work sweeps away practically all of the misunderstandings and obscurities connected with the archaic phraseology of the venerable marine policy, so that it will no longer require an expert in occultism to determine just what is covered and how; it clarifies and simplifies the contract and all of its involved clauses, and supplies a standard, uniform, brief but comprehensive document of all the salient terms and conditions. It is, we repeat, a distinct forward step; something that has been needed and that ought to be in general use. But, alas, custom is strong with the older offices, as self-interest is with the brokers, and it may be pigeon-holed after all.

Singapore Losses

A CONTINUOUS run of serious losses on craft in the harbor of Singapore has led underwriters to inaugurate cooperative action through a special committee for purposes of investigation. Unseaworthiness and over-loading are generally given as the chief causes of these reverses. It is now suggested that a surveyor be appointed to supervise craft at Singapore, the expenses to be met by the interests concerned. American underwriters are less involved than British.

Marine Writings Are Picking Up

WHILE it is admittedly under pre-war volume there are decided indications that the marine insurance business is on the gain. This is accounted for by the encouraging increase in export trade, which last year was but slightly under the normal; the heavy overstocks of American manufactured goods accumulated by foreign buyers during the frenzied purchases of 1919 and 1920 are being worked off, and normal requirements are being filled in a sane and healthy manner. Refined sugar is moving in large quantity to Europe, and food and other supplies for Russian relief are going forward steadily through both Baltic and Black Sea ports. Gold bullion, in considerable amount, is moving from Swedish ports to the United States—probably Russian gold sent by the Soviet government, or by private interests of that country, for the purchase of supplies to supplement the shipments of the United States. A glance at the manifests will show that imports from Europe are steadily improving in volume. The outstanding unfortunate feature of the times, from the viewpoint of the underwriter, is the very low rates quoted by both British and Continental offices. Their motto appears to be, "Get the Business."

Peril in Oil Stowage

UNDERWRITERS have been greatly interested in the recent decision of a British court awarding heavy damages to an American company, owner of the cargo of oil lost when the *Clan Gordon* capsized off Hatteras in 1919. There was a deep cloud of mystery surrounding this disaster, for the vessel left New York in apparently seaworthy condition and turned over in calm weather. By the finding of the Court the steamship company was at fault in failing to instruct the captain to provide water ballast, thus permitting the vessel to sail in unseaworthy condition.

The important point to this case is that care has to be exercised in the proper stowing of a cargo. The average layman is of opinion that the only requisite in loading a ship is to get all the cargo possible on her. The truth is that both the loading and discharge must be scientifically managed, for not alone is it possible by poor loading to impair the stability of the vessel, but by improper discharge the ship may be so strained as to do serious injury to the hull.

Rules for Cleaning Oil Tanks

VALUABLE constructive work has been done by the Marine Fire Hazards Committee of the National Fire Protection Association, and its findings, resultant from more than a year of conscientious work, have been embodied in a report just submitted by a sub-committee. These findings suggest practical ways of combating the fire hazard to vessels, and are based upon the best judgment of recognized experts from the United States Bureau of Mines, the United States Army and Navy, the Shipping Board, and of leading oil companies and dry dock establishments.

The sub-committee's report, while not applying to urgent emergency repairs, gives careful consideration to proposed regulations for the freeing of oil tanks, bunkers and compartments of flammable and explosive vapors previous to entering for any purpose or making repairs. It is proposed to impose a prohibition against making repairs of any kind to any tank, compartment, bunker or other container or space previously containing explosive and flammable liquids, until the requirements hereinafter outlined have been complied with.

The process of freeing such containers of vapor shall be as follows:

1. (a) Tanks shall be closed and live steam blown into the tanks or space to be cleaned and all pipes leading thereto or therefrom for a period of time to be governed by the conditions and the nature of the oil carried. Vent pipes shall be proved and left open. Inasmuch as the time for

steaming will be determined by the foregoing no definite rule is laid down to cover all contingencies, but a carefully worked-out table accompanies the report, and is recommended for use as covering average general conditions. By this table the time of steaming is arrived at by taking the number of hours given in the table, under the actual size of steam connection corresponding to the value given for the volume in cubic feet of the compartment to be steamed. These calculations are based on a steam pressure of 100 pounds per square inch. In steaming tanks the last one-fifth of the steaming period should be carried out with manhole plates or tank lids open to the atmosphere.

Upon completion of this operation the tank or space must be ventilataed thoroughly by means of wind sails, forced or induced draft. Thereafter, specimens of air shall be taken from the tank by a competent chemist, vouched for by the American Bureau of Shipping, and shall be analyzed or tested by him; and should the presence of explosive or inflammable gases still be detected the steaming and ventilating process shall be resumed and continued, after subsequent tests, until the air is pronounced pure.

There are also rules for cleaning tanks for shipyard repairs; also with respect of ventilation, use of tools and lights and gas masks, and the precise kind of permit the foreman must have over the signature of the superintendent.

The National Fire Protection Association is to pass upon these suggestions at its annual meeting next summer. It is more than probable that they will be adopted substantially as they stand.

Loss on the Northern Pacific

LONDON underwriters sustained a loss of $1,200,000 when the Admiral liner *Northern Pacific* was burned and sunk off Cape May on February 9. It is generally reported in the New York market that the rate was ⅜ percent for the trip to Chester, Pa., and for builders' risk while repairs were effected at the yards there. The insurance was captured by London at a rate under what our underwriters were willing to accept, and the heavy penalty falls entirely on the British insurer, less such reinsurance as may have been secured.

The fact that this vessel was one of the fleetest and finest under the American flag, equipped with the most approved safeguards to safety, renders the cause of her destruction peculiarly interesting to underwriters everywhere. If it turns out to have been the dreaded "flare back"—a peril too closely associated with previous losses of oil-burners—there will probably be promptly inaugurated investigations looking to the introduction of safeguards for the reduction of this hazard.

Oil Tank Overflows

AT the risk of appearing to give undue space to oil perils we venture to call attention to the singular problems arising out of the overflowing of the fuel oil tank of the *Cardiganshire* when she was taking on her oil supply at Colon recently. She was bound from Seattle to the United Kingdom. The tank was allowed to overflow in the operation, and considerable damage was done to cargo in the 'tween decks. Who is going to be held responsible? The courts will doubtless be called upon to decide, but, in the meanwhile, there is much speculation on the subject.

Filling fuel tanks is certainly connected with the management of a vessel, and yet the courts will undoubtedly again construe the Harter Act in a way to relieve the carrier of liability, although the consequences of the negligence of one man's servant will thus have to be borne by an innocent party. The underwriter can scarcely be held responsible, for a careful survey of the usual form of the "perils clause" will fail to disclose any mentioned hazard which seems broad enough to include oil damage; certainly not negligence in the filling of oil tanks. It would therefore appear that the unfortunate cargo owner is to be without redress; and that is a hard thing, because he, of all others, was innocent of the cause of the damage, and yet he may be obliged to sit by and see those who were responsible pass scathless through the meshes of the law.

Proposed Lloyds' Legislation

IN view of the long-continued and often acrimonious discussions anent the placing of insurance on American risks with Lloyds, London, and other unauthorized insurers, it is important to note that, as a result of numerous recent conferences between the conflicting interests and the New York insurance superintendent, a tentative form of a marine insurance bill has been drafted that is acceptable to both brokers and representatives of admitted foreign companies. When finally corrected and agreed to by the marine conferees the bill is to be given full publicity and all interests in any way concerned are to be invited to have a part in criticizing and improving it. The Insurance Department takes no position in the matter, either for or against, and only desires to have all interests advised of what is under way and to have a part in the proposed legislation.

Shipowners' Liability in the Courts

UNDERWRITERS have been much interested in the decision recently handed down by United States Judge Jeremiah Neterer, of the Western District of Washington; and for better reasons than that it represented a reversal by his Honor of himself, as of court record of but two months previous. It had under consideration the celebrated case of the steamer *Princess Sophia,* wrecked October 25, 1918, and it grew out of the defense of the ship's owner, the Canadian Pacific Railway Company, against damage suits brought by two hundred claimants because of the loss of three hundred and forty-three lives and much valuable baggage and cargo. The defendant was allowed by the court to plead limitation of liability for loss of life, baggage and cargo. The vessel herself being practically worthless, the claimants will find themselves limited to approximately $8,000 aggregate damages. The captain of the vessel had refused aid when offered by other steamers standing by; but this action, the railway company insisted, it had no hand in. On the question as to whether insurance might be regarded as an interest in the vessel Judge Neterer decided that it could not, citing in support of his position the decision of the Supreme Court in the case of the *City of Norwich,* to wit: "We are not only satisfied that the law does not compel the shipowner to surrender his insurance in order to have the benefit of limited liability, but that a contrary result would defeat the principal object of the law."

Launch of Steamship Matiana.—The steamship *Matiana,* built for the British India Steam Navigation Company by Messrs. Barclay, Curle & Company, Ltd., was launched on January 26 from the firm's West Yard, Scotstoun. The vessel is of the intermediate cargo and passenger type, 485 feet by 58 feet 3 inches by 36 feet, with a gross tonnage of 8,970, and will be propelled by twin screws driven by Parsons double reduction geared turbines, capable of developing a sea speed of 14 knots. The boilers and bunkers are so arranged that the vessel can work either on coal or on oil fuel. Accommodation is provided for 105 first class and 41 second class passengers, the Inchcape system of inner room being adopted so as to give the maximum lighting to living spaces.

Shipping and Shipbuilding In Great Britain

Capital Plentiful for Shipping—High Costs and the Shipping Depression—Shipbuilding Prospects Gloomy But Not Entirely Hopeless

By W. H. Wendon

THE most remarkable feature of the British shipping industry at the present time is the rapidity with which new issues of capital are being subscribed by the public. Three very well-known companies—the Union-Castle Line, the Clan Line and the African Steamship Company—invited the substantial amounts of £2,000,000, £1,500,000 and £1,500,000 respectively. Despite the depressed condition of the freight market and the poor position of trade generally, the new capital was acquired with consummate ease. It is no exaggeration to say that, had the total sum invited by these three companies been ten times what it was, it would still have been forthcoming. As I have hinted, the reasons for this rush to invest in shipping securities are rather obscure, and the fear is already being expressed in responsible shipping circles that, emboldened by this glut of money for liner company issues, tramp concerns of the mushroom type will take advantage of the situation and float wild-cat companies similar to many which were born during the war and post-war boom. Many companies have steamers standing in their books at far above their present values, and investors are being urged to view the solicitations of the managers of these concerns with something amounting to suspicion.

Seamen Accept Cut in Wages

The most significantly optimistic note which the shipping trade enjoys at the moment is in regard to wages. Sailors, firemen and stewards in foreign-going vessels have agreed to a reduction of £2 a month, the cut in the wages of coasting employees being ten shillings a week. This is in contrast with the shipowners' original proposal of a reduction of £3 a month and fourteen shillings a week respectively. Both parties appear to be well satisfied with the settlement. Higher ranks will receive proportionate reductions. A feature of the new scale is that thirty shillings of the £2 will be knocked off on March 1, and the remaining ten shillings two months later. In the words of the official statement: "The settlements are conditional on there being no general and very appreciable improvement in the chartering rates of steamers between January 1, 1922, and the dates on which the reductions fall due."

The position of British shipowners *vis à vis* their Continental competitors is arousing a good deal of interest, and no small comment. The matter has been brought to a head by the President of the Chamber of Shipping of the United Kingdom (Sir Owen Philipps) and deputy chairman (Sir Frederick Lewis) receiving an influential deputation of iron and steel manufacturers on the subject of freight rates on metals. Iron and steel industrialists declare that all costs of production have been reduced very considerably, and at the conference referred to, it was maintained on their behalf that a point had been reached where it was found that the question of freight was the deciding factor whether business should be placed in this country or on the Continent.

Freight Rates on Metals

Sir Owen Philipps, in his reply, pointed to the heavy fall in freights, which he described as being in some cases little more than barely living rates. Fifteen to twenty percent of the whole tonnage of the British Empire is now laid up, and over 1,000 modern steel steamers owned by the United States Shipping Board are out of commission on account of freights being so abnormally low, and, moreover, many British vessels at present engaged in trading are not doing so at a profit. Bearing these salient facts in mind, Sir Owen Philipps said it was desirable to consider whether the f.o.b. prices at which British manufacturers offer their commodities for sale compare reasonably with f.o.b. prices of their foreign competitors. He instanced the fact that, in the case of one recently placed great steel contract, the difference in prices tendered was so enormous that, even if the British shipowner had been satisfied to carry the material for nothing, the British manufacturers' prices would not have been accepted. There was no question of advantage or otherwise in regard to freight charges, as, in the South African trade, the rates of British ships from the United Kingdom and the Continent were identical. Moreover, the British lines, in order to assist the British manufacturers, offered to carry the cargo at whatever rates were taken by foreign lines.

In concluding his spirited reply, Sir Owen Philipps maintained that there was no denying the fact that Continental countries had in some cases got ahead of us. There were many factors which had contributed to this result, such as longer working hours and cheaper labor, the exchange and generally lower cost of production. He believed that British trade, commerce and shipping were faced with very difficult times for the next few years, and the closer they worked together the better.

Economical Ship Operation Vital

High costs and the shipping depression generally were the subject of some interesting remarks by Mr. A. D. Mearns, director and general manager of the Cunard Line at Liverpool. Analyzing the situation, he pointed out that at a recent date there were over fifty million tons of shipping looking for employment—a figure so vast that it was difficult to comprehend. A large amount of this tonnage is tied up in the ports of the world, but, notwithstanding this, Lloyd's Register's latest returns show that at the beginning of the current year there were over 1,000 vessels under construction, with a gross tonnage of nearly 4,500,000. This tonnage, said Mr. Mearns, must be absorbed before they could look for profitable trade, but it was clear that for a long time there would be a floating element of tonnage which would have a detrimental effect upon the profitable operation of the remainder.

The question resolves itself into one of costs, and the ship which can be operated most economically and provide an efficient service is the one that will get the business. The proposition is a simple but vitally important one. With the price of construction three or four times above the pre-war figure, it is obvious that new tonnage is under an immediate disability with its competitors. The sequel is to be found in the idle shipyards of the country, where contracts have been cancelled and thousands of tons of shipping is suspended.

Sir Walter Runciman, who created a certain amount of sensation by repurchasing eight of the steamers which he sold at the top of the boom to the unfortunate Western Counties Shipping Company—taking them back, of course, at a fraction of the sum which he received for them—has just had delivered to him the initial steamer of six which are to run

in conjunction with the re-purchased eight. Messrs. William Doxford & Sons, of Sunderland, are to build these six boats, and the last is to be delivered by June. As to the depression, Sir Walter Runciman is too wise to attempt to predict the length of it, but in his judgment we have a long way to go before we reach rock bottom. He does not think it will be this year, or even next year. He ascribes the reason for his and his colleagues' re-entry into shipowning as being due to the fact that they prefer to manage their own money than leave it in the hands of the Government "to waste."

Shipbuilding on the Clyde Slack

Clyde shipbuilders, in common with those in other great construction centers, continue to look to the future with anxiety. In this connection it is noteworthy that in some quarters—notably in the lay press—false deductions are being drawn from the fact that in January the Clyde placed into the water the record total of 56,414 tons gross, representing nine vessels. Prior to this the highest tonnage launched on the river was 39,910 tons in January, 1920. The reason for the figure climbing to 56,414 tons is, of course, that it included such large vessels as the P. and O. liner *Bendigo*, of 13,100 tons, and the *Athenia*, of 12,000 tons.

Far from there being a "boom," as is suggested by the uninitiated, the launching of these and other vessels simply means that so many additional berths are rendered vacant. The most important new contract—indeed, almost the only one worth recording this month—is the twin-screw steamer to be built by Scott's Shipbuilding and Engineering Company, of Greenock, for Messrs. Alfred Holt and Company's Blue Funnel Line. Her dimensions will be 400 feet, by 52 feet, by 32 feet, and her most interesting feature is that she will be propelled by Scott-Still engines, which represent the latest development in marine propulsion, and embody a new principle consisting of a combination of an oil engine and steam engine. The boat's twin-screw machinery will develop 2,500 brake horsepower and particular significance is attached to this decision to install an entirely new class of machinery.

Holt Liner To Have Still Engines

Details of the "Still" system are not devoid of interest. It appears that rather more than a year ago Scotts' Shipbuilding and Engineering Company acquired a license for the manufacture of the Still engine, and built an experimental set, upon which prolonged trials were carried out. The results are said to have definitely proved that the "Still" engine has a lower consumption than any other type of prime mover now being manufactured commercially. In the new vessel for the Holt Line, two of these motors, each of 1,250 horsepower, will be fitted. It is claimed that a thermal efficiency is reached some 15 or 20 percent in excess of that of the ordinary four-cycle Diesel engine. Although this will be the first ship equipped with "Still" engines, a great amount of experimental work has been carried out in the past ten years.

New Liner for Glasgow-Canadian Service

The passenger and cargo steamer *Athenia*, to whose launching I have already referred, is to engage in the Anchor-Donaldson Line's Glasgow Canadian service. She has been constructed by the Fairfield Shipbuilding and Engineering Company, of Glasgow, is of the shelter deck type, with straight stem and cruiser stern, and has two steel masts. Her principal dimensions are 520 feet, by 66 feet, by 42 feet, her gross tonnage is 12,000, and her loaded draft 27 feet 8 inches. The propelling machinery consists of two sets of Brown-Curtis double reduction geared turbines. Steam is supplied by three double-ended and two single-ended boilers, arranged to burn oil, and with a working pressure of 210 pounds per square inch. Accommodation is provided on the bridge deck amidships for 354 cabin passengers in staterooms arranged for one, two and four berths. On the shelter deck, which extends almost the full length of the ship, accommodation is provided amidship for 162 cabin passengers. The third-class passenger accommodation is situated on the upper deck and main deck, the cabins being fitted for two and four passengers in each room.

Shipping and Shipbuilding Prospects Not Hopeless

On the occasion of the launching of the *Athenia*, Sir Alexander Kennedy, managing director of the Fairfield Shipbuilding Company, referred at some length to the shipping and shipbuilding depression. He maintained that, while the immediate prospects are not bright, the position is not entirely hopeless. In pointing to the seriousness of the depression, he recalled that in 1908—the worst pre-war year within recent times—the total tonnage commenced was 787,500; in 1909 it was 1,165,000 tons; in 1910 1,349,000 tons; in 1911 1,904,000 tons; in 1912 2,099,000 tons; and in 1913 1,855,000 tons. Passing to the war period, we find that, in the artificial boom of 1919, there were commenced vessels representing 2,391,000 tons, and in the continuation of that boom throughout 1920 there were 2,351,500 tons. But in 1921 the total was only 518,300 tons. The slump last year came with startling suddenness, and of vessels commenced the total was practically one-third less than that of the previous worst year. Turning to costs and values, Sir Alexander Kennedy declared that there would have to be a full realization of the actual facts, and a determined effort on the part of everyone to bring values and costs into closer relationship.

Labor Troubles

At the time of mailing this review, the labor outlook in the engineering industry in Great Britain is a dubious one. Negotiations are in progress between the masters and the men, but the results are so far unsatisfactory. The position is as follows: During the war and since, it has been the common practice for the unions in the engineering shops to say exactly what overtime should be worked. Not unnaturally, the employers wish to alter this. As the result of a conference between the Engineering and the National Employers' Federation and the representatives of the workers, proposals were put forward which in effect gave each employing firm the right to dictate the circumstances in which overtime should be worked. These proposals, endorsed by the executive of the Amalgamated Engineering Union, went to a ballot of the men. In the result, 35,525 voted in favor of the proposals and 50,240 against, or a majority of 14,715 against accepting the terms. The position at the moment is that the decision has been officially reported by the union to the employers, who are considering what next step can be taken.

Scandinavian Shipping

The statistics recently issued by the Norske Veritas show that the Norwegian merchant fleet at the beginning of this year comprised a total of 2,500,000 tons, or an increase of 200,000 tons as compared with last year.

The Swedish mercantile marine with a total of 1,090,000 tons shows a net decrease of 10,000 tons.

The Danish mercantile marine has increased during the last year by 85,000 tons, making a total at the commencement of the present year of 870,000 tons.

At the end of 1921 there were under construction in Sweden 38 ships of 86,640 tons, in Denmark 38 ships of 82,233 tons, and in Norway 53 ships of 77,330 tons. However in all three countries work has been suspended on a large number of vessels.

The New White Star Liner Homeric

Magnificent Express Steamer for High Class Transatlantic Travel Arrives in New York on Maiden Voyage

THE *Homeric* of the White Star Line should be of particular interest to the marine field because she is the type of steamship that is most needed today. Her success as a business venture is practically assured. Whatever may be the losses suffered in the carriage of freight, due to the world surplus of cargo ships, it will be some time before there are enough passenger ships to take all of the ever-increasing traveling public. Passenger fares are higher than they ever were and the *Homeric*, due to her superior accommodations, will be able to command the maximum rates.

Designed with a definite view of providing the greatest possible degree of personal comfort to each and every passenger, yet ranking as one of the greatest transatlantic liners, the *Homeric* is a ship of distinctive character. The facilities of a private yacht exist in her for rendering intimate, personal service to the individual, the family, or the tourist party. In her bedrooms the old-time upper berth has been eliminated, and with it generations of tradition; in her dining rooms small private tables, in varying sizes, predominate.

(From a painting by Charles Dixon)

White Star Liner Homeric

Principal Characteristics

Length	777 feet 0 inches
Beam	83 feet 0 inches
Depth, bridge deck to keel	100 feet 0 inches
Horsepower, reciprocating engines	28,000
Speed, normal	20 knots
Gross tonnage	33,526
Displacement, tons	42,000
First class passengers	491
Second class passengers	422
Third class passengers	1,740
Crew	750

Upon the completion of the *Majestic*, the world's largest ship, the White Star Line will have three vessels on the weekly service between New York, Cherbourg and Southampton, having a total tonnage of (*Majestic*, 56,000; *Olympic*, 46,439; *Homeric*, 33,526) 135,965 gross tons.

Interior Arrangement

A distinctive feature of the *Homeric* is the size of her public rooms which in some cases are larger than similar rooms on the *Olympic*. The lounge, for example, is considerably larger than the lounge on the *Olympic*. The arrangement of the public rooms, which are on the upper deck, is in the form of an imperial suite, each room being distinguished by an impressive and marked character.

At the forward end of the deck, under the navigating bridge, is a drawing room, with large plate glass observation windows. Next comes a reading and writing room, and next the lounge. Beyond this is a music room, and still further on the smoking room with a glass enclosed sun veranda completing the group. The view down the full length of the rooms, at the sides, from drawing room to sun veranda, presents an unbroken vista of 340 feet.

The Lounge

The architectural design and adornment of the lounge on the *Homeric* reminds one of the interior of a Roman mansion. Its length is 94 feet, its width 47 feet, and its ceiling is 20 feet high, with a great central dome of amber glass through which the light comes as through champagne.

On either side of the room is a colonnade of fluted Doric pillars, with bases and capitals richly gilt—a commanding decorative feature, with tall windows between, from which the light falls through harmonious draperies.

The color tone of this sumptuous room, ivory and gold, is relieved by blue. The ceiling has deeply carved panels in gilt against a ground of old blue. A carpet of wonderfully deep pile has large circular designs of blue and old rose on a ground of gold. The central part of this carpet is removable, uncovering a ballroom floor inlaid in a design of stars, in two kinds of walnut. This space has a capacity for 300 dancers. When the dancing space is not in use the entire lounge is arranged with tasteful groups of beautiful furniture, each of a distinctive style of period, and noteworthy for its rich and varied upholstery.

At either end of the room are large canvases, one portraying Columbus landing on the soil of the New World, the other his reception by Ferdinand and Isabella. Smaller panels, at the corners of the room, represent in classic figures the elements—earth, air, fire and water.

Library and Dining Room

The reading and writing room is just forward of the lounge. Book cabinets are installed along the forward wall. Double writing desks of mahogany with ebony ornaments are placed along the sides in recesses lighted by casement windows. The arm chairs for the desks, which revolve on ball bearings, have their bases fixed.

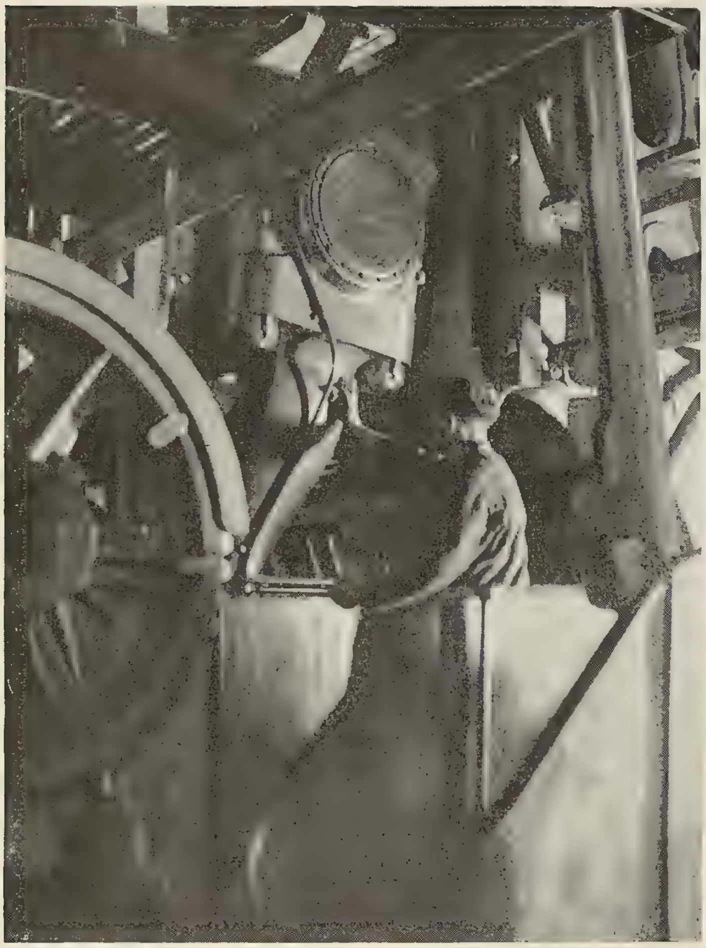
A green marble fireplace, having winged seats, is fitted on one side of this room. In the center of the room is a great round reading table located under a skylight. The color tone of this room is ivory and olive green with a touch of old rose in the carpet and hangings.

Next forward of the library is the drawing room, reached through two square arched openings. This is a charming observation post, giving a wide view ahead, through broad plate glass windows. Everything here is light and airy, like a summer garden. The furniture is chiefly in white enamel—graceful chairs and settees, cushioned in green velour; circular garden sets in lattice, for palms and ferns, and small round tables, with choice marble tops. The hangings are in delicate solid colors.

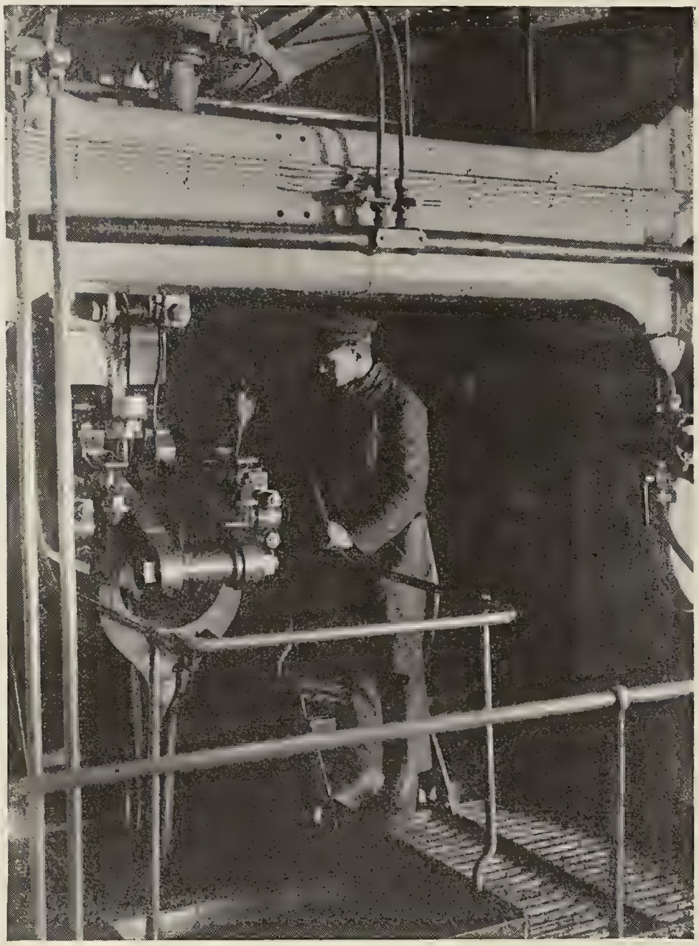
The Music Room

The special feature of the music room is the light touch with which the joyous character of music is expressed in its decorations. The carpet is very delicately colored with great nosegays of pink rosebuds on a ground of soft gray while the border is a pale blue.

On the walls are two large paintings, done in the manner of tapestries, with scenes from Mozart's opera "The Magic Flute"; on one hand is the sleeping princess approached by the Moor; on the other, the elfin bird catcher making magic music to his fantastic little lady love. This room has a mantel in delicate marble with bronze ornaments and mirrored panels surmounted by symbolic ebony carvings on a gold ground.



Crosshead End of Connecting Rod



Showing Link of Valve Gear

The Smoking Room

The smoking room is a lofty rectangular apartment, 38 by 50 feet, its high walls wainscoted to the top in small panels of dull-finished walnut, and with a ceiling of carved wood, done in flat white, the room conveys at first glance a message of dignity and repose.

The greater dimension is across the ship, terminating on either side in bow windows 18 feet high, hung in silk curtains of buff and olive, in perfect harmony with the ripe tone of the walls and the opulence of the massive overstuffed pieces, some in colored wool tapestries, others in deep green morocco, with which the room is furnished. Beside each window is a tall-backed winged chair in red morocco, and on either side of a marble fireplace is a great tapestry armchair, promising the ultimate in comfort. In suitable positions are small, marble-topped tables.

Let into the upper walls are four laıge panels done in oils in the Dutch manner, still life studies of fruits, flowers and game, flanked by carvings symbolic of sports, while over the mantel is a large painting of a young woman mounted for the hunt.

Beyond the smoking room, and reached from it by an arched exit, up three broad steps, is a glass enclosed sun veranda, from which a clear view astern may be obtained.

The First Class Dining Saloon

The dining saloon, which is situated on *D* deck amidships, has a seating capacity for 500 persons. A great inverted dome of crystal pendants, which reflects the brilliancy of hundreds of concealed electric bulbs, centered in a ceiling of white and gold, is fitted over the lofty central portion.

There are galleries on both sides from which an impressive view of the room below may be had. The color tone of the dining room is jade green, ivory and gold. The tables are mahogany, the arm chairs mahogany frame with seats and back cushions of morocco.

Staterooms and Baths

On this ship the staterooms might be more properly called bed rooms. The oldtime upper berth has given place to twin metal beds with box springs and hair mattresses. The smaller rooms have single metal beds either of the conventional or berth bed type. Many of the rooms have a shower bath and toilet attached and a large number have fixed wash basins with running hot and cold water. The suites are fitted with private bath rooms and there are also an unusual number of public bath rooms.

Special Features

The following are among the special features with which this ship is equipped: A complete telephone system supple-

Striking Interior Views on White Star Liner Homeric

(1) First Class Dining Saloon; (2) Lounge, Showing Colonnade of Doric Pillars; (3) Music Room; (4) Electric Bake Oven.

ments the usual installation of electric bells for service calls; two electric elevators are situated in the first class quarters and one in the second class; a gymnasium for both men and women; an electric ray bath; hair dressing parlors; a dark room for amateur photographers and a typewriting room.

The *Homeric* was built at the Schichau yard in Danzig, Germany, and was just about ready for service when the war broke out in 1914. She remained in Danzig until 1919, when she was taken to Hamburg, where the interior work necessary for her service in the White Star fleet was finished.

Oil Tanker Fort McHenry Launched

THE tanker *Fort McHenry* was launched at the Baltimore Dry Docks lower plant, Locust Point, Baltimore, Md., of the Bethlehem Shipbuilding Corporation, Ltd., on February 1. Mrs. John Philip Hill, wife of Congressman Hill, of Maryland, sponsored the vessel.

The vessel is classed at American Bureau of Shipping rating A-1-E and at Lloyd's rating 100-A-1, both with the

Tanker Fort McHenry Just After Launching

notation "carrying petroleum in bulk." The construction and equipment are in accordance with the latest rules of the United States Supervising Inspectors of Steam Vessels.

The principal particulars of the *Fort McHenry* are:

Length, overall, 354 feet 6 inches.
Length, between perpendiculars, 340 feet 0 inches.
Beam, molded, 49 feet 0 inches.
Depth, molded, 28 feet 7 inches.
Load draft, 23 feet 6½ inches.
Deadweight tonnage, 6,050.
Speed, 10 knots.
Type of engine, triple expansion.
Size of engine, 23 inches by 39 inches by 65 inches by 42 inches stroke.
Indicated horsepower, 2,000.
Number of boilers, 2.
Type of boilers, single end, Scotch.
Size of boilers, 15 feet 6 inches by 11 feet 5¾ inches.
Kind of fuel, oil.

The vessel is built on the Isherwood system of longitudinal framing, with a straight stem and semi-elliptical stern. The machinery is aft. The cargo space consists of 14 main cargo oil tanks and 8 summer oil tanks separated by oil-tight transverse and longitudinal bulkheads. A deep tank is fitted between the pump room and fore peak for fuel oil, with the hold and 'tween decks above the tank available for dry cargo.

The *Fort McHenry* will be completed, ready for service, about April 1.

Non-Toppling Block for Boat Falls

IN compliance with a recent ruling of the United States Steamboat Inspection Service that "when more than one lifeboat is served under one set of davits means shall be provided that will prevent the davit tackle from twisting or capsizing and that will permit the tackles being readily rounded up for the purpose of launching the remaining lifeboat under such davits," the Steward Davit and Equipment Corporation, New York, has developed a non-toppling and non-twisting block to be used for lifeboat falls.

The principle evolved to prevent these blocks from capsizing or toppling lies in definitely confining the path of each rope in the upper part of the lower block and also by providing a very wide mortise, easy running sheaves and by

The Conventional Blocks

The Steward Blocks

keeping the center of gravity of the block low down. The sheaves are mounted on large bearing pins and, although they are bronze bushed, provision is also made for lubrication.

By flaring the upper portion of the side plates of the lower block, it has been possible to utilize the rivets and spacing pieces as runners to insure a line entering and leaving the block without binding or toppling. Just sufficient clearance is provided for an easy run out of the block on the opposite side. A heavy well-proportioned swivel link is supplied in the bottom of the lower block for attachment directly to the release gear in the lifeboat.

On the side of the lower block, the non-twisting arrangement is fitted. This consists of a flat bar attached to the block to which is shackled a length of light wire rope connected to a similar pendant attached to the opposite block at the other end of the boat. This arrangement prevents twisting of the blocks and has been recommended by the British Board of Trade as well as having been accepted by the United States Steamboat Inspection Service.

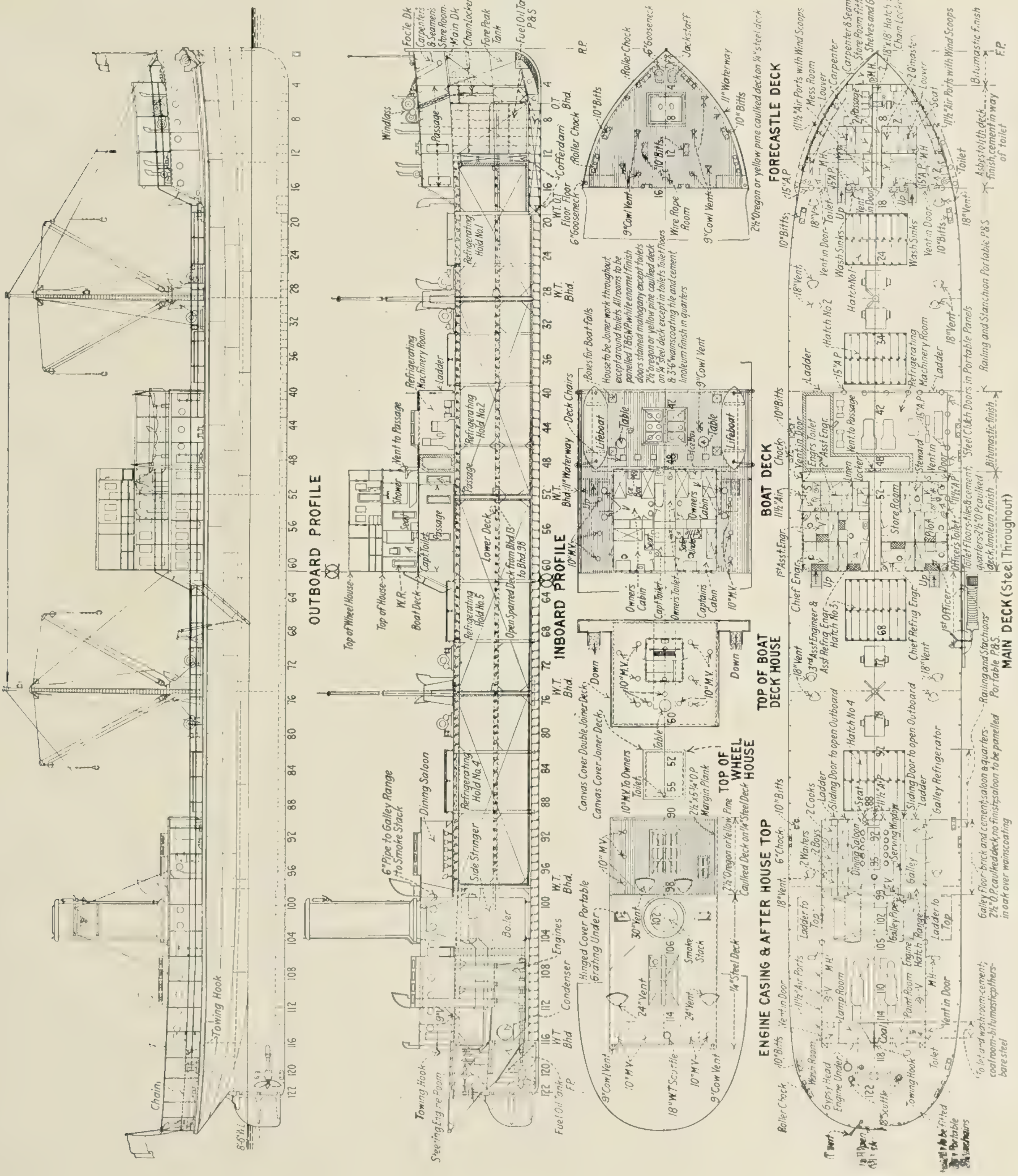
Shallow Draft Refrigerator Steamers

Vessels Built for Service on South American Rivers—The First American-Built Steamships to Fly the Paraguayan Flag

TWO twin screw shallow draft refrigerator steamers have recently been built at the Moore plant of the Bethlehem Shipbuilding Corporation at Elizabethport, N. J., for the International Products Steamship Company, of New York. These vessels are of the single deck type with a raised forecastle and are designed for service on the rivers Parana and Paraguay in South America.

Cargo Equipment

Cargo is carried in four holds which are insulated



General Arrangement Plans: Shallow Draft Refrigerator Steamer

Shallow Draft Refrigerator Steamers

General Information

Service: Transportation of frozen or chilled meats from Asuncion, Paraguay, to Buenos Aires, Argentina.

Builder: Moore Plant (Elizabethport, N. J.), of the Bethlehem Shipbuilding Corporation, Ltd.

Owner: International Products Steamship Company, New York.

Characteristics

Length, overall	254′ 0″
Length, B. P.	245′ 0″
Breadth, molded	40′ 0″
Depth, molded	18′ 7″
Draft, loaded	8′ 6″
Draft, light	
Block coefficient	0.804
Midship section coefficient	0.98
Longitudinal coefficient	0.82
Speed, loaded, miles per hour	12
Cruising radius, nautical miles	
Framing	Transverse
Class, Lloyds 100 A-1	

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	878
**Weight Propelling Machinery	122
Deadweight Capacity	948
Displacement	1,948

(In tons of 100 cubic feet)

Gross register	1,625
Net register	962

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

(1) Bower anchor, stockless	2,856 lbs.
(1) Bower anchor, stockless	2,352 lbs.
(1) Stream anchor, ex-stock	725 lbs.
(1) Kedge anchor, ex-stock	392 lbs.
Chain cable, 1½″ stud	210 fms.
(1) Streamline, 3½″ steel wire	75 fms.
(1) Towline, 3¼″ steel wire	90 fms.
(1) Hawser, 6″ manila	90 fms.
(1) Hawser, 5″ manila	90 fms.

Rudder

Area	
Dia. Stock	
C. Press, abaft C. L. pintles	

Complement

Deck officers	3
Deck crew	6
Engineer officers	4
Engineer crew	7
Purser's and steward's department	5
Total officers and crew	25
First-class passengers	none
Second-class passengers	none
Third-class passengers	none
Total passengers	none
Total complement	25

Handling Equipment

	No.	Type	Capacity	Length
Mast	2	Pole	....	.....
Derrick posts	..	...	....	.....
Booms	4	wood	3 ton	34′ 0″
Discharging Cap.				

Deck Machinery

Steering Gear, Bethlehem steam gear with telemotor control.

Windlass (1), steam	6 × 6
Capstans (1), steam	6¼ × 8
Winches (4), steam	8¼ × 8

Life Saving Equipment

	No.	Type	Length
Lifeboats	2	.....	20′0″

Propelling Machinery

Boilers

Number	2
Type	B. & W. watertube
Length	
Width or Diameter	
Furnaces	
Fuel	oil
Draft	forced
Total heating surface, square feet	4,110
Total grate surface or furnace volume	
Superheat, degrees F.	
Working pressure, lbs. per sq. in.	180
Normal fuel consumption:	
Per day, tons	11
Per horsepower hour, pounds	1.14
Normal steam production:	
Per hour per pound of fuel	lbs.
Total per hour	lbs.

Engines

Number	2
Type	triple expansion, reciprocating
Size	11-18-29 by 20
Horsepower, total indicated	900

Propellers

Number	2
Type	semi-steel, 4 bladed
Weight, lbs	2,056
Diameter	6′ 9″
Pitch	6′ 9″
R. P. M.	180
Projected area, sq. ft.	17.95
Developed area, sq. ft.	21.5

Auxiliary Machinery

Machinery Space

Condenser (1), surface condensing type, 1,600 sq. ft. cooling surface.

Evaporators	
Distiller	
Filters	
Feed water heater	(1)
Fuel oil heaters	(4)
Pumps	
Main feed, vert. simplex	8 × 5 × 12
Centrifugal circulating	5 × 7 engine
Air, vert. simplex	7½ × 14 × 10
Aux. feed, vert. simplex	8 × 5 × 12
Fire & bilge, horiz. duplex	9 × 5¼ × 10
Fresh water, horiz. duplex	4½ × 3¾ × 4
F. O. Service (2), vert. duplex	4½×3×4
F. O. transfer, horiz. duplex	5¼×4¾×5
Sanitary, horiz. duplex	5¼ × 4¾ × 5
Refrig. circulating, horiz. duplex	7½ × 8½ × 6
Forced draft blower	4 × 4 eng.

Refrigerating Machinery

(2) York, 15 ton ammonia machines.

Electric Equipment

Generators (1)	7½ K. W.
Radio	
Emergency	

Holds

No.	Length	Hatches
1	32′ - 0″	12′ × 14′
2	46′ - 0″	12′ × 14′
3	46′ - 0″	14′ × 14′
4	46′ - 0″	14′ × 14′

Capacities

Cargo Space (Refrigerated)

Compartment	Cu. Ft.	Tons
Hold No. 1	16,256	171.11
Hold No. 2	25,147	264.70
Hold No. 3	25,162	264.86
Hold No. 4	25,134	264.56
Total	91,699	965.23

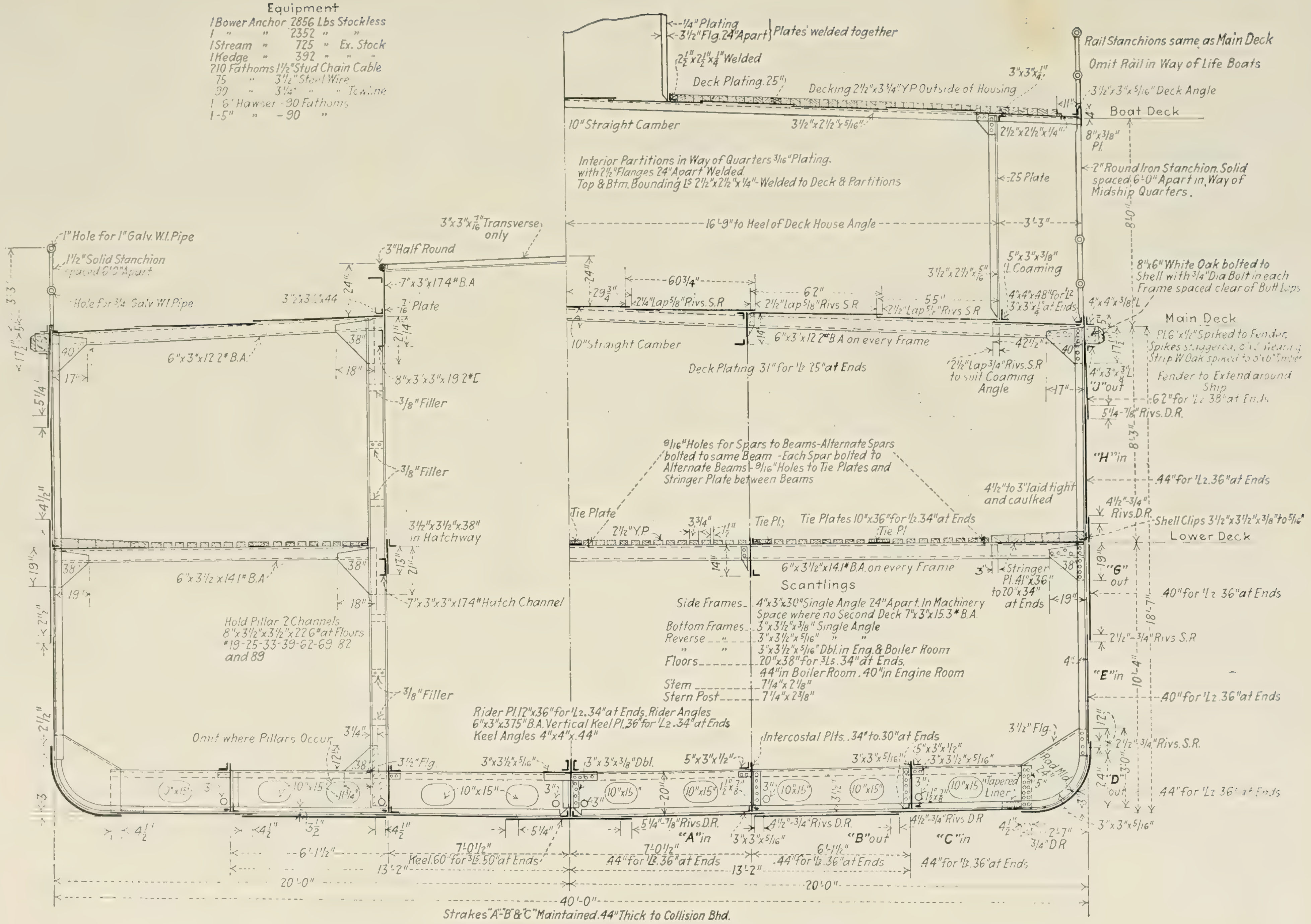
Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons
For'd deep tank (S)	2,407	....	59.10
" " " (P)	2,407	....	59.10
For'd bottom tank (S)	557	....	13.68
" " " (P)	557	....	13.68
Settling tanks (S)	388	....	8.30
" " (P)	338	....	8.30
After peak tank	904	....	22.18
Total	7,508	....	184.34

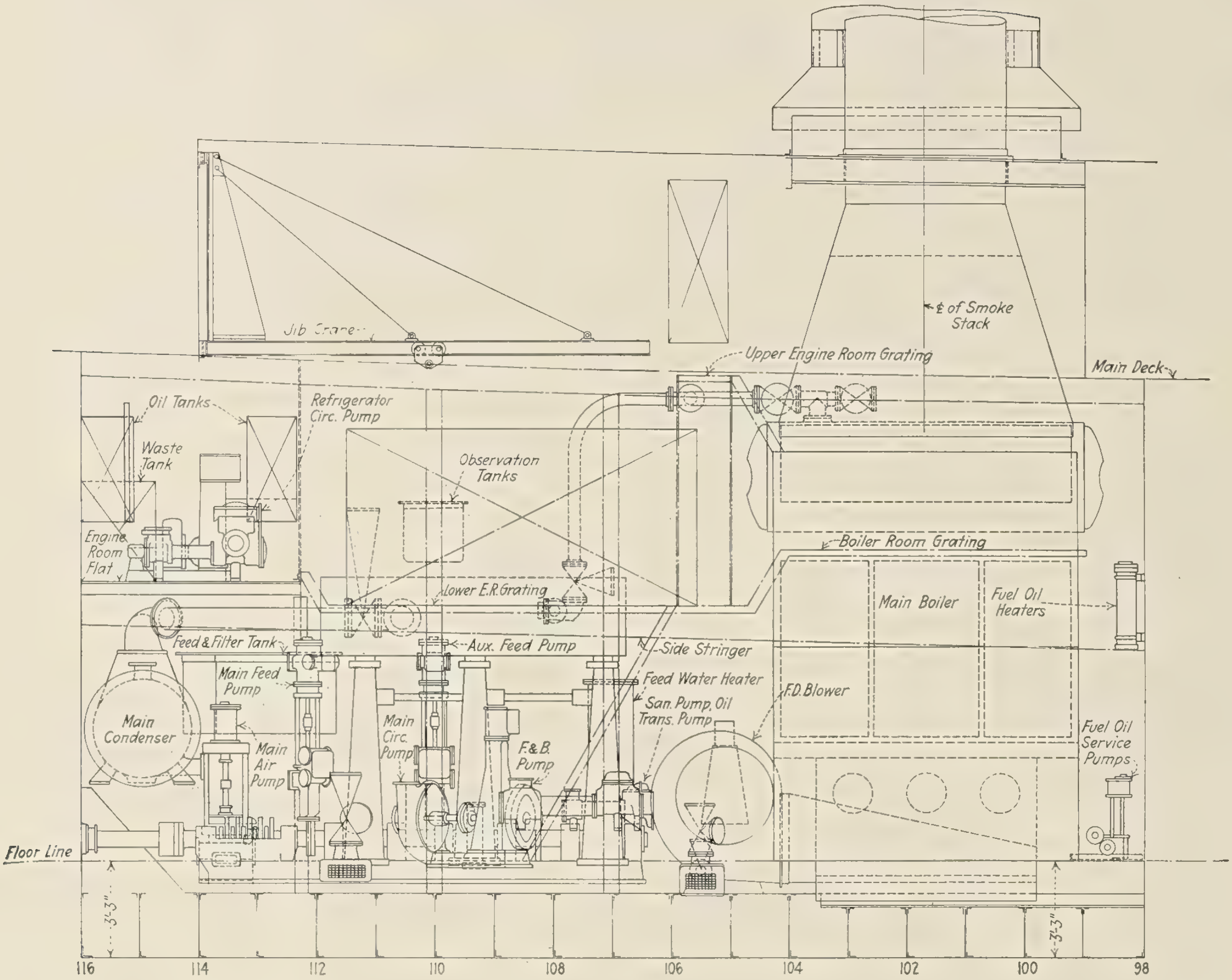
*38.1 cu. ft. per ton; ....gals. per bbl

Tanks

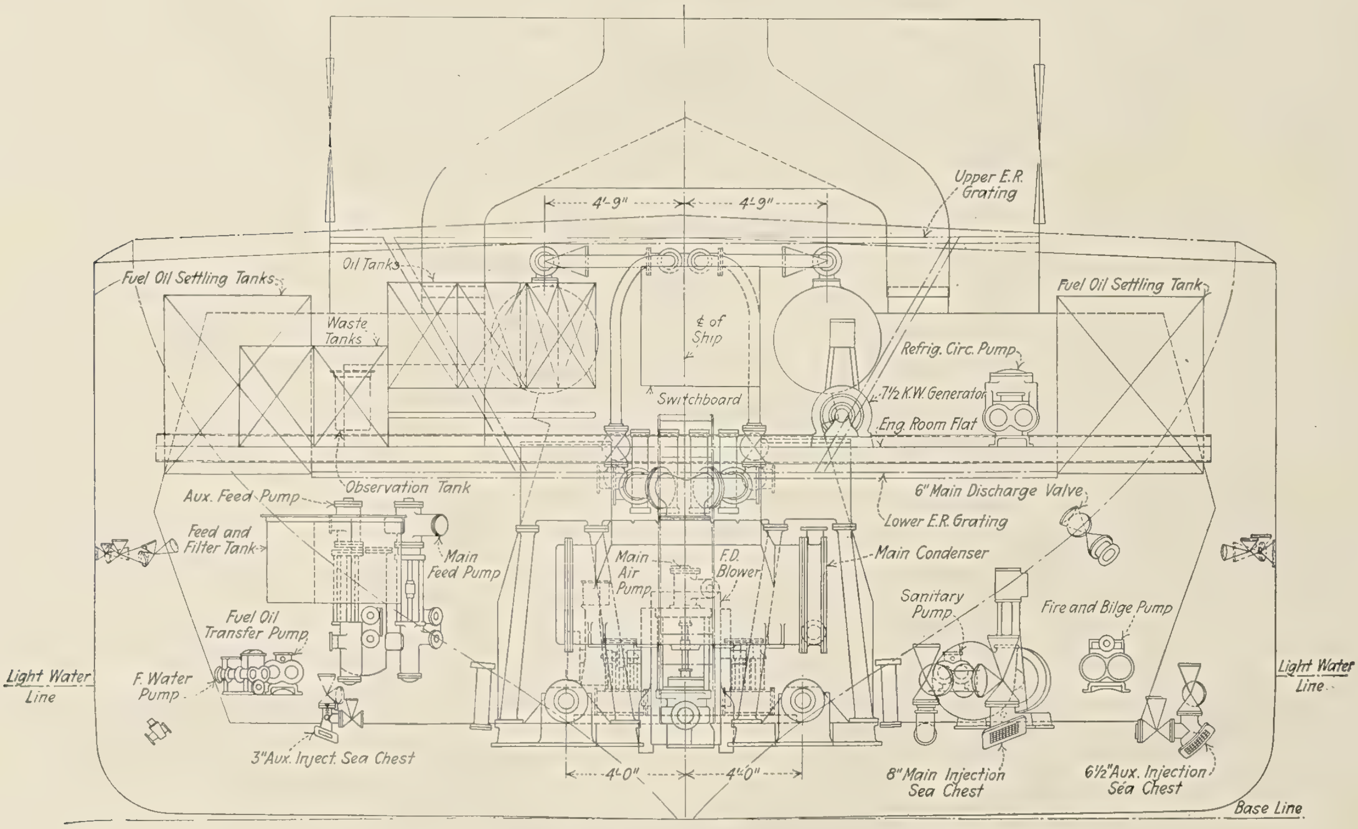
Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Fore Peak	1,581	....	45.0
After Peak	904	....	25.7
Drinking water	...	0.41	....
Sanitary	...	0.41	....
Total	2,485	0.82	70.7



Midship Section of Shallow Draft Refrigerator Steamer



ELEVATION



CROSS SECTION AT FR. NO. 116 LOOKING FOR'D

Sections Through Engine and Boiler Rooms: Shallow Draft Refrigerator Steamer

throughout for transporting frozen or chilled meats from the company's plant at Asuncion to Buenos Aires. The refrigerating machinery consists of two 15-ton ammonia machines and is installed in a steel house on the upper deck forward of the officers' accommodation. During tests a temperature of 13 degrees F. was easily maintained in all holds.

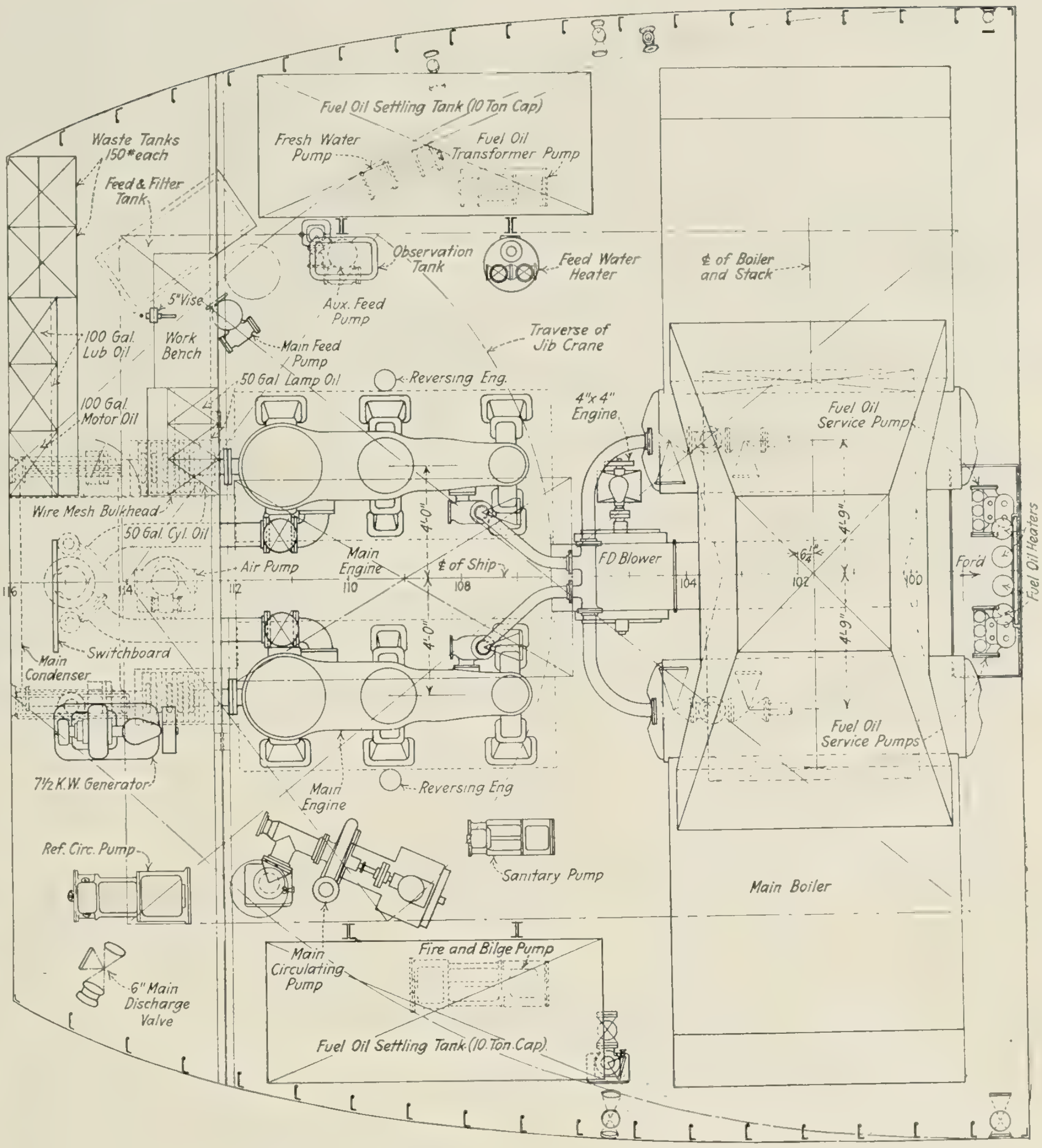
Each cargo hold is served by one winch and derrick for handling cargo overside into the ocean-going steamer or barges alongside.

Accommodations

Great care has been taken in laying out quarters to provide ample ventilation for the hot weather. Officers and engineers are quartered in a house amidships, all these rooms being outside. On top of this steel house accommodations are provided for the captain and owner. The owner's staterooms have all modern conveniences.

The crew are berthed in the raised forecastle.

A large dining saloon is provided in a steel house aft just forward of the stack, with the galley arranged on the starboard side and accommodations for the cook and steward on the port side.



Plan of Engine and Boiler Rooms: Shallow Draft Refrigerator Steamer

The propelling machinery is placed aft and consists of two triple expansion engines capable of driving the vessel at a speed of 12 miles per hour. Steam is supplied by two Babcock & Wilcox oil burning watertube boilers. The boilers are designed to work under natural draft, but forced draft has been installed to take care of any and all conditions of weather encountered on river service. Three Lodi type burners are fitted to each boiler.

These steamers are the first to be built in this or any other country to be registered under the Paraguayan flag.

Plan of Relief for Pioneer Purchasers.—The Shipping Board on February 9 announced that it had decided upon a plan of extending some relief to the "pioneer" ship purchasers, who paid or agreed to pay high prices for their tonnage, providing they will purchase for cash additional tonnage of the ships the board now has for sale, on a basis that will enable them to average down or equalize the price of their total tonnage to a basis of present replacement cost, the price to be determined in accordance with the individual circumstances existing in each case, so that the capital charge will be reduced to a figure that will enable them to compete. The pioneer purchasers acquired some 150 ships aggregating 1,000,000 tons.

Individual High-Voltage Motors Operate Successfully on Tietjen and Lang Floating Dry Dock

Although 2,400-volt motors had previously been used on floating docks using a single motor to drive all pumps on a side where geared centrifugal pumps or bucket pumps were used, the Tietjen & Lang Dry Dock Company, Hoboken, N. J., was unable to locate satisfactory references of the use of individual pump motors for voltages higher than 440 when considering new equipment in 1920 for their No. 6 dock, which had been in operation since 1900 with steam driven bucket pumps.

It was decided to change this to a complete system of electrically controlled pumps and motors. This installation, which was supervised by W. H. Reed, electrical engineer for Tietjen & Lang, has now been in service about one year and offers an interesting service record of completely satisfactory performance under unusual conditions.

Description of the Dock

The dock may be briefly described as consisting of sections or pontoons each 80 feet long with an extreme width of 111 feet. Each pontoon is divided into three compart-

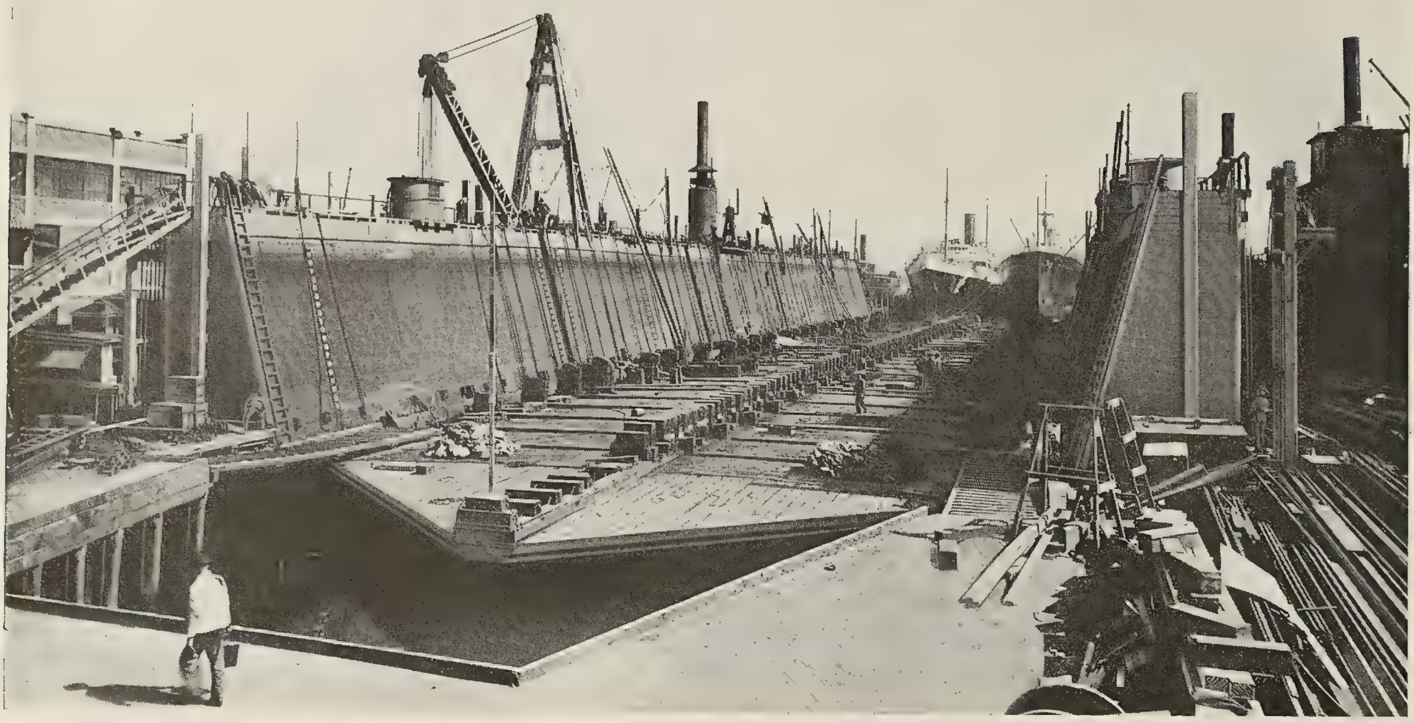


Fig. 1.—Tietjen and Lang Floating Dry Dock No. 6

ments of equal size by longitudinal bulkheads. The depth of the pontoons is 12 feet 3 inches and the height from the deck of the pontoons to the deck of the wing is 29 feet. These pontoons when placed together form a dock having an overall length, including outriggers, of 468 feet. A photograph of the dry dock is shown in Fig. 1.

The pumping equipment formerly consisted of twelve plunger pumps in each pontoon. These pumps were actuated through reduction gears by line shafts which extended along the decks of the wings, one on each side, and were driven by upright steam engines which, with their boilers and auxiliary equipment, were located on the decks of the wings of the center pontoon.

After considerable investigation of the type and form of apparatus best suited to meet the particular requirements, the pumping equipment of the Alberger Pump and Condenser Company, New York, and the electrical equipment as manufactured by the General Electric Company, Schenectady, N. Y., were selected.

The New Pumps and Motors

The pump equipment was somewhat unusual in that self-alining guide bearings on the intermediate shaft, as recommended by the manufacturer, were used with complete success in avoiding any strains on the shaft from the slight distortion occurring in a wooden dock. All pumping equipment was manufactured by the Alberger Pump and Condenser Company, one pump being located in the center compartment in each wing of each of the five sections, a total of ten pumps, each with an individual motor, permitting the utmost flexibility in control. The suction lines leading from each pump are terminated by foot valves which bring the suction within a few inches of the bottom of the pontoons. The vertical shafts of the pumps have been extended up through the wing spaces and steadied by self-alining bearings, and end in flexible couplings on a level with the decks of the wings. Just below the flexible coupling thrust bearings of the roller type are placed, which sustain the weight of the pump shafts and impellers.

The electrical equipment consists of ten General Electric vertical, squirrel cage type, 360 revolutions per minute, constant speed induction motors, designed for 75 horsepower capacity in 150 horsepower frames and for use on 2,400-volt, 2-phase, 60-cycle alternating current circuits. The motors are coupled by means of flexible couplings to the shafts of the pumps.

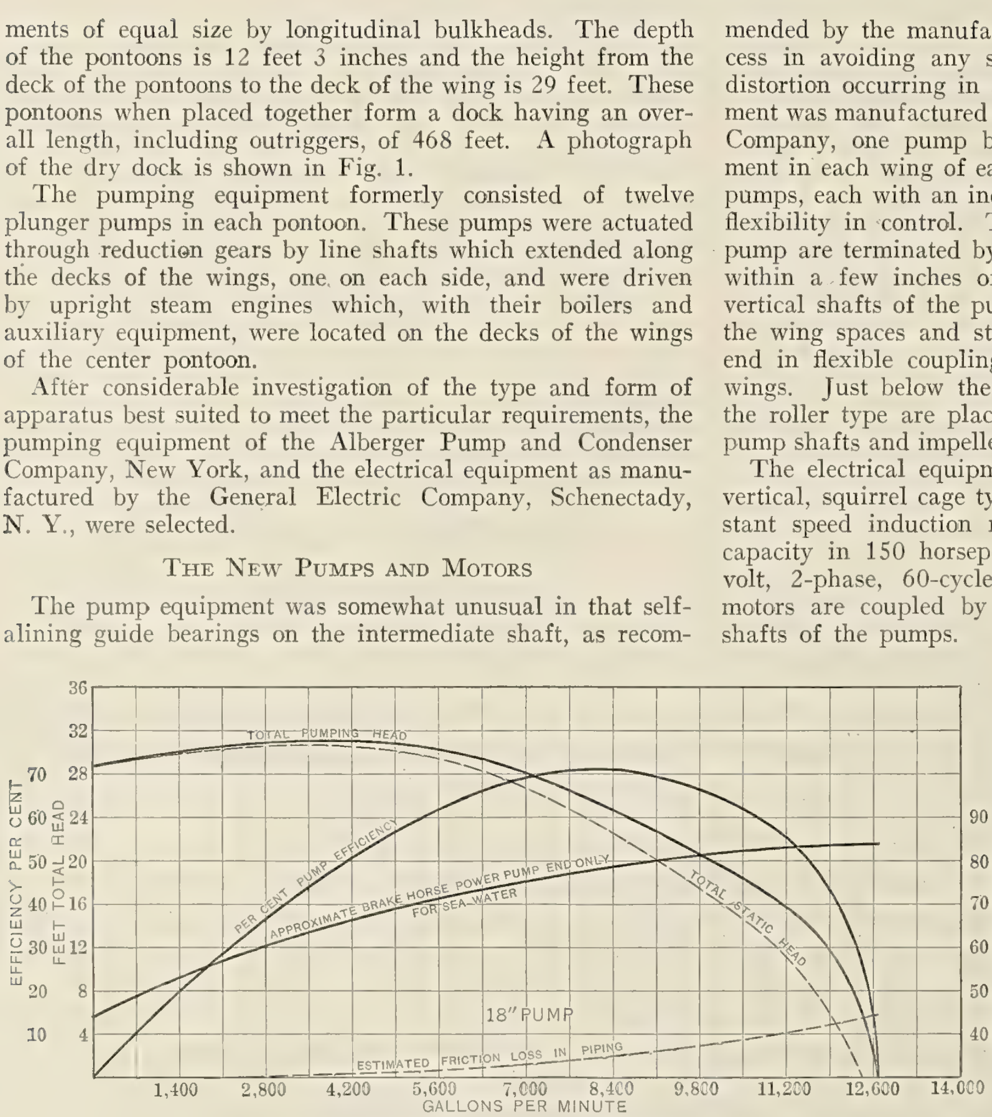


Fig. 2.—Pump Characteristic Curves

The motors are housed in wooden structures which are arranged to be heated electrically to prevent condensation through temperature changes which might otherwise affect the life of the motor insulation, due to "breathing."

Push Button Control

The control equipment for the motors has been installed in a fireproof brick structure near the head end of the dock. The equipment consists of ten push button control automatic starting compensators, each having a capacity of 75 horse-

power. These compensators are banked together to form a five-panel switchboard and have their disconnecting switches, current limiting and overload relays on the front of slate panels with the contactors and compensation coils mounted on iron pipe frame work.

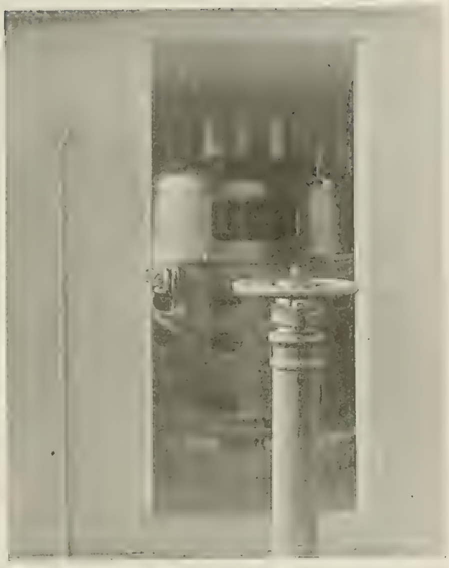


Fig. 3.—One of the Pump Motors

The push buttons controlling the starting and stopping of the motors are grouped on a slate panel which is twenty-four inches square. This is shown in Fig. 4.

When the dock is being operated the push button control panel is in charge of an operator who receives his instructions from the dock master. As the motors are of constant speed, his duties consist of starting and stopping the motors as directed. A bell system for signalling from the outboard end of the dock has been arranged for transmitting instructions from the dock. At other times the operator receives manual signals from the dock master at the inboard end of the dock.

Electric Circuit System

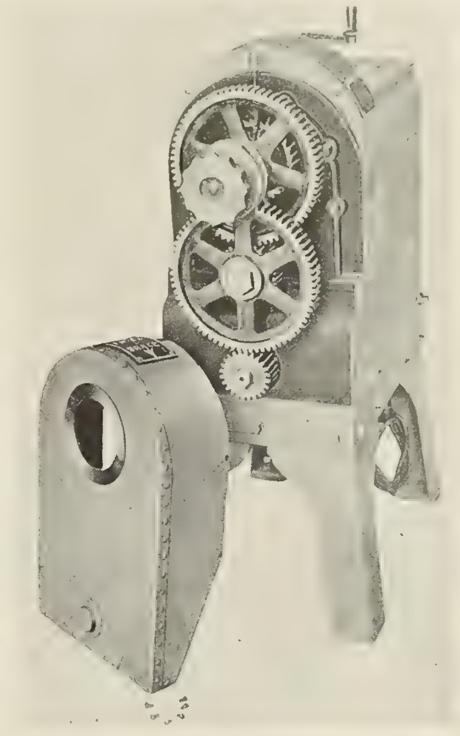
The electric circuit system can be described briefly. Each motor is on a separate circuit and all circuits originate in the control building. Iron conduits are installed from the control house of two wood structures. One of these is on the inboard end of each side of the dock. Rubber-insulated, lead-encased cables designed for 5,000 volts service are used. To make connection between the wood structure and the dock special extra flexible cable, known as "dry dock cable," is used. The circuits are carried along the outboard side of the dock in iron conduits and terminate in brass connection boxes at the ends of the section. The connection boxes are arranged with fiber spacers and filled with insulation compound. Connections between the sections are made with "dry dock cable." Particular attention has been given to making the wiring system watertight and special precautions taken to have all parts of the system "grounded" where required.

Fig. 4.—Push Button Control Board in Dock Master's Office

It is of additional interest to know that a portion of this equipment was installed during the time that the dock was still being operated by means of the old steam equipment and bucket pumps, the dock being out of service to complete the installation of the new pumps, piping and electrical equipment only sixteen calendar days until the first lift was made with the new equipment, this time being sufficient also for the removal of the old steam equipment and its pumping gear. The new equipment was put into complete service on October 26, 1920, and has operated with complete satisfaction.

Rotary Brake Sounding Machine for Depths Up to 100 Fathoms

SOUNDINGS up to a depth of 100 fathoms without decreasing the speed of a vessel or losing the lead and wire have been made with a new Lietz rotary brake type sounding machine which consists of a mechanical sounding device driven by a General Electric one horsepower motor. A special feature of the machine, which is an improved type of a former design, is the brake mechanism which consists of a mounted shaft having a hollow portion on which the reel for the wire revolves. The brake clutch is rigidly mounted and is operated through the hollow portion of the shaft by means of a screw which, engaging with the rolling members in the hollow portion of the shaft, causes expansion and contraction of the brake clutch which rotates with the reel and shaft while winding in.



Lietz Rotary Brake Sounding Machine

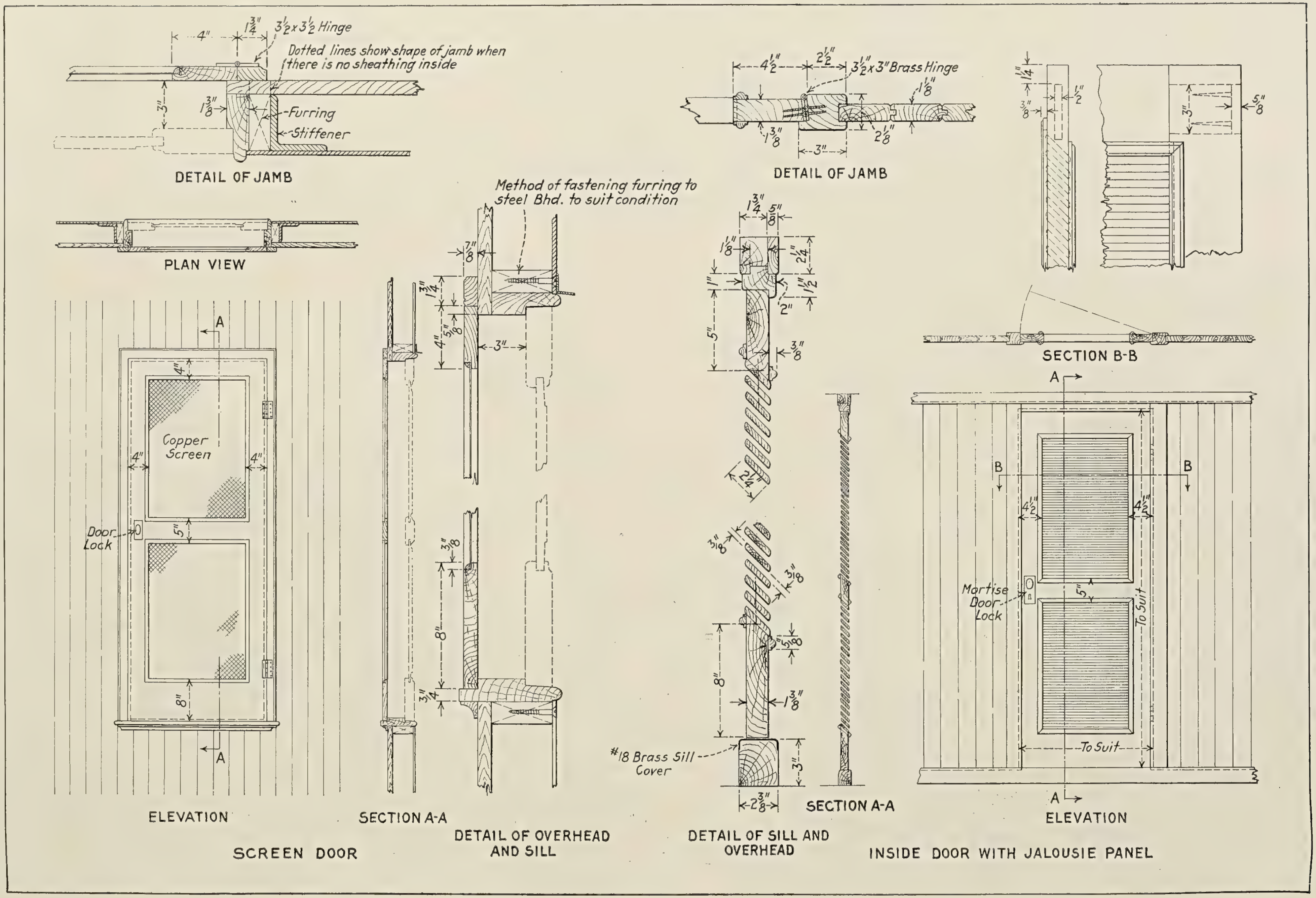
The braking mechanism is actuated by a brake wheel on the outside of the casing and acts on the reel gradually, preventing its stopping suddenly with the consequent loss of the wire and lead. An indicator is located on the case near the brake wheel which shows which way to turn it to free the reel and let out the wire or to brake the wheel for winding.

Although normally designed for operation by a one horsepower motor, the device is arranged so that it can be worked manually if desired. In this case disconnecting the motor from the gearing is unnecessary as the motor armature acts as a flywheel. All parts of the machine are easily accessible for inspection or repair.

Munson Line Gets New Ships.—A. J. Frey, vice-president of the United States Shipping Board Emergency Fleet Corporation, in charge of operation, has announced that the *Pan-American,* formerly the *Palmetto State,* has successfully completed her trial trip and has been delivered to the Munson Line of New York, which will operate her in the South American service. Mr. Frey also announced that the *Western World,* formerly the *Nutmeg State,* now in process of completion at the Sparrows Point yard of the Bethlehem Shipbuilding Corporation, will also be delivered to the Munson Line the last week in April, to be placed in the same berth. With the completion of this vessel the Shipping Board construction program will come to an end.

Ship Joiner Plans

Inside Doors



Munson Liner Munargo, Built for Passenger and Freight Service to the West Indies

New Munson Liner Munargo Goes Into Service

Fifteen-Knot Geared Turbine Passenger Steamer, Built by New York Shipbuilding Corporation, Added to Munson Fleet

THE latest addition to the increasing fleet of the Munson Steamship Line, New York, is the passenger and cargo ship *Munargo,* recently completed at the plant of the New York Shipbuilding Corporation, Camden, N. J. The new vessel is 414 feet long and 57 feet 6 inches beam, with a draft of 23 feet 8 inches. She has accommodations for 185 first class, 60 second class, and 52 third class passengers with a crew of 119, and in addition has a cargo capacity of 2,000 tons.

Driven by reduction geared turbines of 5,800 horsepower, supplied with steam from five boilers, fired by fuel oil, the *Munargo* will maintain a speed of 15½ knots in service. The boilers are of the Scotch type and the turbines of the Parsons type driving the propeller through DeLaval reduction gears.

The staterooms are replete in modern conveniences, including specially designed dressing tables, beds, electric fans, etc. The old type of berth has been largely superseded by specially designed enamelled beds. The suite rooms on the promenade deck are finished in a light natural grey toned to match the hangings while the trim is either mahogany or French walnut, according to the period of the furnishings. The suite rooms, as well as the special rooms on the bridge deck, have their own private bath rooms connecting.

The public rooms are numerous, light, airy and exquisitely finished. They include a social hall, lounge and music room, smoking room, library and writing rooms, entrances and galleries. A sun and dancing deck for first class passengers has been provided on the boat deck over the smoking room.

The dining saloon is located on the shelter deck, over the center of which is located a large dome and light well opening into the music room. Tables are arranged for small and large parties. Specially designed buffets, etc., blend harmoniously with the surroundings.

Lounge

Smoking Room

An extensive refrigeration plant is installed with separate compartments for meat, fish, vegetables, butter and eggs, etc., and is of ample capacity for any emergency.

Ventilation and heating throughout the ship have been cared for in a very complete manner, insuring comfort at all times whether in the intense heat of the tropics or the extreme cold of the North Atlantic.

Separate complete hospitals are provided for passengers and crew, fitted with modern appliances.

Accommodations for the second and third class passengers are all aft and far surpass the accommodations furnished in older ships. Public rooms, including a social hall, smoking and music rooms, are provided to insure comfort at all times.

Accommodations for the officers and crew are for the most part located on the boat deck with enclosed companion ways for access, so there is no need of coming in contact with the passengers.

The ship has been built on the transverse system of framing and to take the highest class in the American Bureau of Shipping and Lloyd's Register. The *Munargo* starts her career as an oil burner, but is so designed that conversion to coal will not be a difficult matter should it become desirable.

Dining Room

Together with the other additions to the Munson Line this class of ship will go a long way towards eliminating the absence of passenger vessels under our flag in the West India and South Atlantic services.

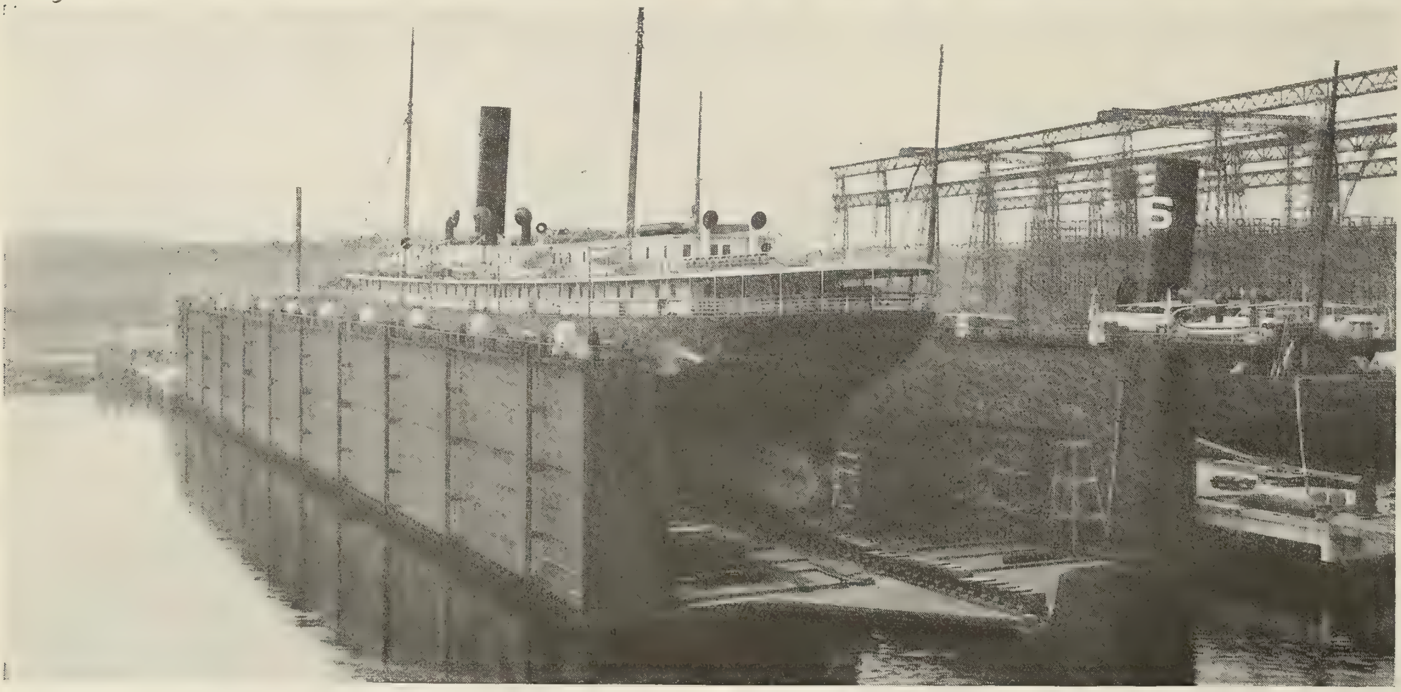
New Floating Dry Dock at Fore River Shipyard

Bethlehem Shipbuilding Corporation, Ltd., Installs a 10,000-Ton Dry Dock of the Donnelly Type at Its New England Plant

THE only floating dry dock on the Atlantic coast between Halifax and New York City is located at the Fore River plant of the Bethlehem Shipbuilding Corporation, Ltd., Quincy, Mass. Supplemented by the large machine, boiler and plate shops of the shipbuilding plant, this dock offers excellent facilities for serving the port of Boston.

The dry dock is of the well-known Donnelly type and has a capacity of 10,000 tons. In order to give berthing space to vessels requiring attention without the necessity of docking, a repair basin is provided adjoining the dock. Transportation facilities and crane service for vessels in either the dock or repair basin are carried on a mooring pier that is 50 feet wide and 616 feet long, measured from the bulkhead line.

On this pier are located two standard gage railroad tracks and the track for a 15-ton tower crane. The standard gage tracks are imbedded in the concrete in order to leave a clear roadway for motor trucks and other vehicles. The third rail for the crane and the pipe lines are placed in trenches along the sides of the pier, so arranged as to make T-beams of the adjoining crane stringers. In order to allow for shrinkage and expansion due to changes in temperature, two transverse expansion joints are provided in the deck of the mooring pier. Projections of the sliding floor beams, which engage corresponding recesses in the stationary floor beams, prevent the pier from getting out of alinement. The columns supporting the mooring pier located nearest the shore rest on piles



Donnelly Type Floating Dry Dock of 10,000 Tons Lifting Capacity at the Fore River Shipyard

while the columns located in deep water rest on bed rock.

The dry dock consists of ten wooden pontoons under continuous steel side wings. A timber outrigger projects from each end pontoon. Two shore bridges leading from the head pier to the deck give access to the latter, and a swinging ramp connects the port wing wall to a steel landing tower near its in-shore end. The vertical motion of the dock due to the tides and when submerging or rising is guided by side and end moorings anchored to the concrete piers.

Each pontoon is 116 feet wide and 40 feet 10 inches long. The wing walls are 418 feet 9 inches long and 35 feet high, tapering on the inside from a width of 13 feet at the bottom to 8 feet 6 inches at the top. Connection between the pontoons and wing walls is made by means of links. Each link engages two pins, one of which is attached to the pontoon and the other to the wing wall.

The pumps for discharging the water from the pontoons and wings when the dock is raised are electrically operated from a control house on shore. Electrical connections are such that by means of individual switches the pumps of any pontoon can be operated independently of the others or, by means of a master switch, the pumps of all pontoons can be operated simultaneously.

This feature provides means whereby the stresses in the vessel being docked may be equalized by utilizing the individual control and bringing decreased or increased upward pressure to bear on certain pontoons, as required.

The first vessel docked was the *Miller County*, on February 12, 1921. The completion of the dock has filled a long-felt want in providing vessels entering the port of Boston with convenient and modern facilities for having repairs made to hull or machinery.

The British Shipbreaking Industry

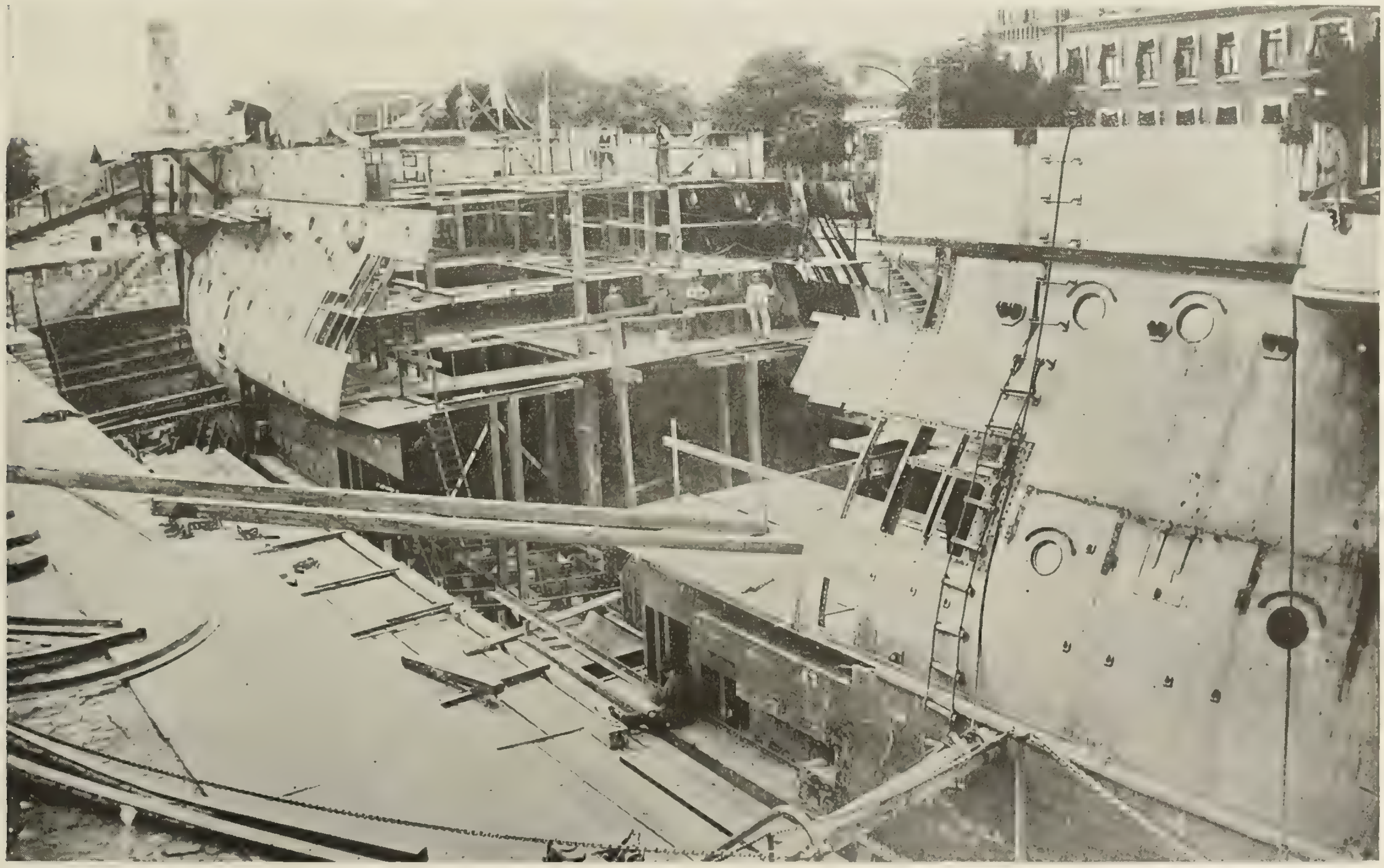
Non-Ferrous Metals Are Most Valuable—Hardwoods Sold for Furniture—Steel Cut Up for Melting

By Our London Correspondent

THE shipbreaking yards of the United Kingdom are at the present time veritable hives of industry. During the war, when tonnage was so precious, every vessel, no matter what its age or condition, was able to secure its freight and the shipbreaking trade fell into abeyance, but, with the cessation of hostilities and the flooding of the market with new vessels, the industry entered into its own, with the result that probably every shipbreaking yard in the country has enough work to keep it going at all events for the current year. And in the background looms the Washington Conference, with its gigantic scrapping of warships to add to the mercantile marine break-up.

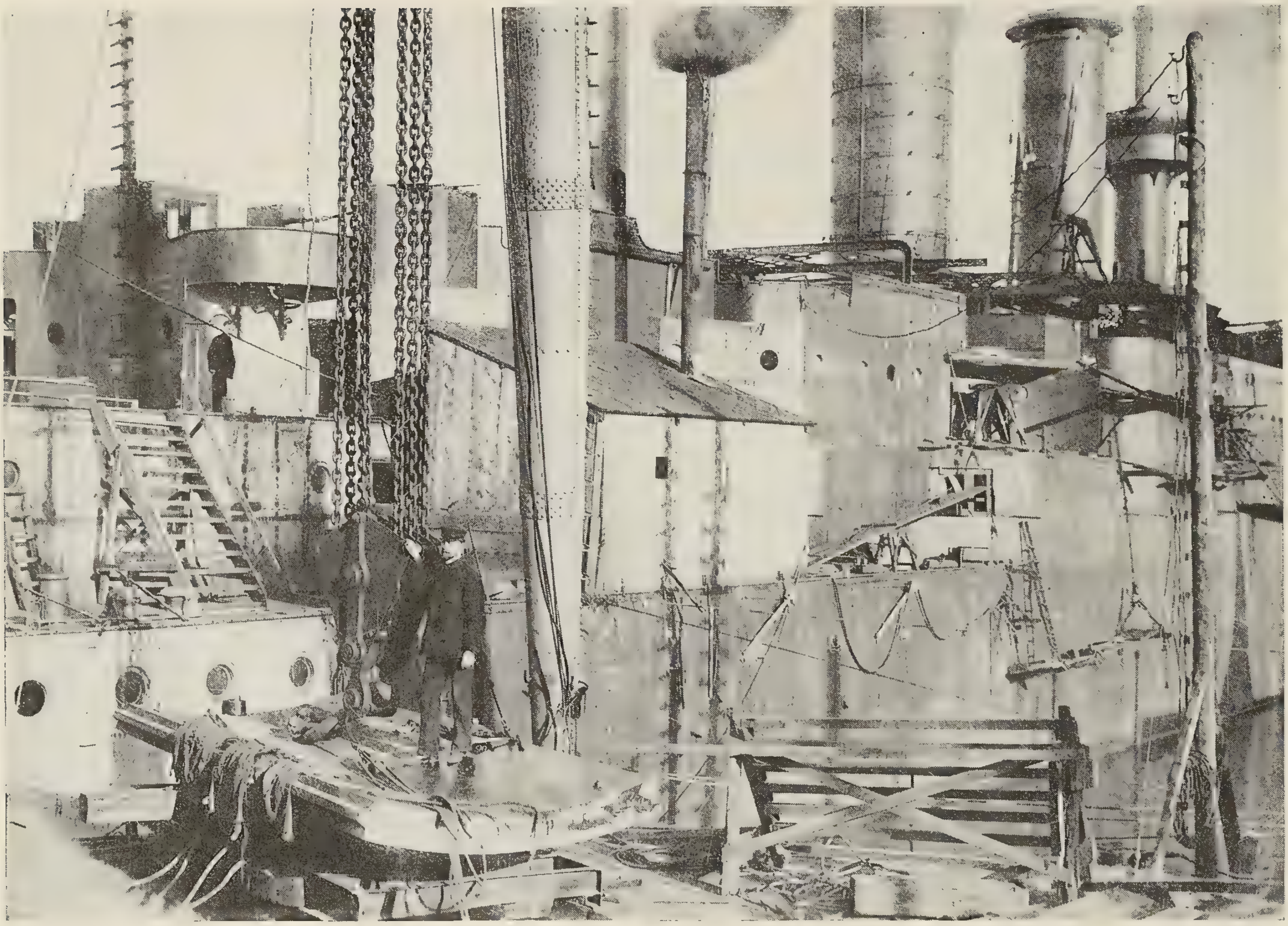
Process Adopted by Thos. W. Ward, Limited

One firm, the introduction of whose name into an article of this description needs no apology, is Thos. W. Ward, Lim-



(Photograph copyright by Kadel & Herbert News Service, N. Y.)

Breaking Up a German Warship in a Dry Dock



(*Photograph copyright by Kadel & Herbert News Service, N. Y.*)

Removing Armor Plate from German Warship While Afloat

ited, of Sheffield. The process adopted by Messrs. Ward in destroying a warship is a highly developed one. The first operation is to remove the deck fittings, and then comes the difficult operation of taking up the deck. At this point I should make it clear that it is not the practice to take out the engines and boilers in the early stages of breaking up, this being left until the upper portions of the vessel have been dealt with. The engines and boilers are thus easier to get at. For the deck lifting operation, oxygen and acetylene are combined to eject from a pipe a flame of great intensity. Large squares are cut out of the decks and swung by crane on to the quay. With the disappearance of the decks, the engines and machinery come to view and with wrench and hammer the breakers detach large portions for the crane to lift clear. Then come the compartments, the officers' quarters, the boilers and the shaft. Having come to the empty shell, the oxy-acetylene flame gets to work again, and the sides of the hull are cut into squares. On the quay, steam shears cut pieces of steel into sizes that will fit the furnaces for which they are intended, most of the steel finding its way to South Wales, where it is melted down.

A Stripping Method

The method adopted by another well-known firm in demolishing vessels is to strip them of their metal, machinery, fittings and equipment, but, before selling the metal, this is cut up into crucible sizes, as there is a more ready market. The teakwood is removed very carefully and is usually sold to people in the furnishing line. With regard to the hulk, this is also cut up into furnace size by means of the oxy-acetylene burning plant. At present, owing to the slump in the scrap trade, this is hardly a paying proposition but a little improvement on current prices would certainly make it so.

A firm which does not break up iron and steel ships, but limits its work to old wooden battleships, tows them from the dockyards to its shipbreaking wharf, where they are demolished, the timber being converted into whatever it will make. Americans, I am told, are buyers of old ship oak for building purposes, where the antique design is carried in this material.

Pitfalls Await the Inexperienced

The pitfalls for those about to establish shipbreaking businesses are many, even for the wary, and the advice of Mr. Lawrence Levy, one of the most experienced men in the shipbreaking industry in Great Britain, is, similarly to that of *Punch* to those about to marry—"Don't!" *En passant,* it is interesting to note that the company of which Mr. Levy is managing director—the Shipbreaking Company, Limited, of London, Swansea, etc.—has dealt with all types of vessels during the past quarter of a century, and since the armistice has undertaken the demolition of no fewer than twenty-five ex-German submarines, in addition, of course, to other craft.

To those embarking on breaking up submarines Mr. Levy tells me that the first essential point to bear in mind is to clear the vessels absolutely of oil—whether fuel or lubricating. His firm strips the boats to their very bottoms, for the simple reason that, if the steel were not stripped entirely, a considerable quantity of metal would go to waste. It is not

the custom to take the hulk out and sink it; but, by the time the breakers have achieved their work at the wharf the portion of the vessel remaining is negligible and it is then finished on the beach. In the big battleships there is, it is true, a certain amount of teak and so on to be salvaged but in the majority of cases there is little of real value beyond the scrap non-ferrous metals. Mr. Levy emphasizes that, when engaged on submarines in docks, it is advisable to have somebody on board—as, for example, an ex-naval officer—to supervise the dismantling.

Wages an Important Factor

As I have indicated, Mr. Levy does not regard the profession of shipbreaking as a means to easy and plenteous wealth, more particularly at the present time when wages and most other charges are high and the value of the metals obtained stands at only a tithe of their figure during the war, consequent on the trade depression and the superabundance of new metal at low costs. With regard to wages, Mr. Levy instances that, whereas in this country shipbreakers' employees receive about £3 for a week of forty-seven hours, in France the corresponding wage is equivalent, at the present rate of exchange, to about seven shillings for a ten-hour day. The wages cost alone in Great Britain represent, therefore, nearly double those just across the English channel; so the value of the steel portion of the vessels does not cover the cost of recovering the steel scrap.

In view of the depreciated rate of exchange in Germany, it is scarcely surprising that some of the contracts in the hands of British shipbreakers have been transferred to German yards, to the mutual advantage of the contractors and sub-contractors.

Motorship Building in Europe

Motorships Without Auxiliary Compressors—Geared Diesel Vessels—New Types of Engines

By Our Special London Correspondent

SCARCELY a month passes without bringing forth some striking innovation in motorship machinery. Having apparently convinced shipowners that the modern marine oil engine is equally as reliable as a steam plant, manufacturers are tending towards simplified construction, mainly with the idea of reducing the cost of building. At present the machinery of a motorship costs some 20 to 25 percent more than that of a corresponding steamer equipped with reciprocating engines and shipowners are demanding that this somewhat considerable difference should be reduced. So far as can at present be gathered, the tendency will be towards simplification and therefore cheapening of auxiliary machinery, the development of compressorless Diesel engines and more efficient standardization in manufacture. By this means various firms are hopeful that within the next two or three years, the engine room installation of a motor vessel will cost no more than that of a steamer.

An example of this line of thought is seen in the motorship *Handicap*, which sailed on her maiden voyage at the beginning of the year. The propelling plant of this vessel is in any case a noteworthy installation, embodying as it does the first examples of the new Sulzer two-stroke engine using turbo scavenging blowers instead of large piston pumps driven direct from the engine crankshaft. A fully illustrated description of this arrangement was recently published in MARINE ENGINEERING AND SHIPPING AGE and need not be repeated. It may, however, be remarked, surprising as it would appear, that by installing two turbo blowers in the engine room each driven by a 150 brake horsepower electric motor, there is an actual saving in weight as compared with similar engines driving their own scavenging air pumps as are usually installed.

These turbo blowers occupy very little space, being arranged in enclosed compartments in the wings of the vessel and the engines, being naturally reduced in length by the elimination of the scavenging pump, allow of an engine room

1,350-Ton Single Screw Motorship Balzac, a New Type for Service in European Waters

probably shorter than that of any vessel equipped with machinery of equal power (2,700 brake horsepower).

What is most remarkable in this ship, however, is that there is no auxiliary air compressor. The air required for starting and maneuvering purposes is supplied wholly from the blast injection compressors on the main engines and on those used for driving the dynamos. This system has never previously been employed and although the cost of one or two electrically driven compressors is avoided it is somewhat doubtful whether the plan is desirable. The builders claim that there is plenty of compressed air available above that required for the fuel injection, and that it is unnecessary to install two further maneuvering compressors. It is improbable that any British shipowner would agree to take the risk thus involved, the vessel being Norwegian owned. Indeed it is somewhat doubtful whether an installation of this sort would pass Lloyds. Nevertheless, if it is perfectly successful, it may have a far reaching effect for the result is an engine room of extreme simplicity, comparing favorably with most other installations.

Geared Diesel Ship for the Hamburg-American Line

Whether there is a future for the geared Diesel ship as some shipbuilders and shipowners appear to imagine is a controversial question and the Hamburg-American Line has shown some temerity in putting two such vessels in service. The second ship, the *Munsterland*, was completed early in February. She is exactly similar to the first vessel of this class, being 465 feet in length and having a deadweight capacity of nearly 11,000 tons. There are two ten cylinder four cycle engines installed, which run at 230 revolutions per minute although originally designed for a much higher speed. They develop 1,650 brake horsepower each, and drive the propellers through a reduction gear of 2.7 to 1 so that the propellers turn at 85 revolutions per minute.

Whatever may be said regarding the reliability of engines of this type the Hamburg-American Line has undoubtedly acquired motorships costing less than any other vessel of their size built during the past few years. It is understood that the engines, which were originally designed for large German submarines, were obtained at a very low figure and, owing to their lightness, the deadweight capacity of the vessels is larger than almost any others of corresponding dimensions.

New Types of Diesel Engines

Unanimity of Diesel engine design seems as far off as ever. Several new types have been brought out during the past month or two. The first Beardmore Tosi engine has been completed and installed in the 2,500-ton motorship *Pinzon*. This motor is noteworthy chiefly from the adoption of a combined inlet and exhaust valve which, it is claimed, overcomes exhaust valve trouble and avoids the frequent cleaning necessitated with the ordinary design.

Another new engine is a 1,200 brake horsepower set, constructed by the Atlas Diesel Company of Stockholm, of the two cycle type which goes one better than the Sulzer and provides a design in which each cylinder cover has only one valve, namely the fuel valve. Scavenging air enters, and the exhaust gases are discharged, through ports in the cylinder liner and starting is effected by enclosing the bottom of the cylinder and causing the lower section of the cylinder below the piston to act as a maneuvering engine when starting and a scavenging pump when the motor is running. This naturally involves a somewhat complicated system of air distribution and it is questionable whether the system is an improvement upon the Sulzer method with the starting valve in the cylinder cover. The scavenging air supplied in this way from the six working cylinders below the piston is not sufficient for the requirements of the engine so that there is an additional scavenging pump driven by a beam lever from one of the crossheads. This engine has just passed through its trials for installation in a single screw 5,000-ton cargo vessel.

Another German Design

The third new type is that developed by the Deutsche Werke in Kiel at the old Royal Naval Dockyard. The first examples of the engine are about to be installed in an 8,000-ton motor tank ship. Like so many other German builders, the Deutsche Werke decided to adopt the four-cycle principle and there is little that is original in the construction except that each engine is made self-contained with its air compressor, lubricating oil, circulating water and general service pumps, driven by levers off the engine crossheads. This again has been adopted with the idea of reducing the cost of construction and of minimizing the number of auxiliaries in the engine room.

Something of a revolution is predicted in Diesel engine construction in the near future although a great deal of secrecy is observed at the present time. A new engine is being built by two or three of the leading Continental manufacturers, the main advantage of which is the elimination of the compressor. This is effected, not by employing mechanical injection at very high pressure as has already been adopted in several successful engines, but by another device which enables the fuel to be pumped through the fuel valve at a pressure of only a few pounds per square inch. It is expected that the new design will be placed on the market in the very near future and a very considerable reduction in cost of construction compared with the air blast type is anticipated.

14,000-Ton Motorship

The Royal Mail Steam Packet Company has just taken delivery of its first motorship, a vessel of 14,000 tons deadweight named *Lochkatrine*. This is the largest type of oil engined vessel afloat, equipped with twin screw machinery of 6,400 horsepower built by Harland and Wolff of the usual Burmeister and Wain design. The fuel consumption of this ship when carrying a full cargo at a speed of about 13½ knots is about 20 tons daily.

Another interesting new vessel is the *Dominion Miller*, built by Doxfords for the Furness Withy Company and representing the second ship equipped with the remarkable 3,000 horsepower Doxford opposed piston oil engine. Incidentally it may be remarked that the manufacturers of this type are so satisfied with its performance that they are now quoting for single engines up to 6,000 brake horsepower. In order to demonstrate that the opposed piston engine can run on boiler fuel oil a seven days' trial was recently made, using Mexican fuel oil (.95 specific gravity), the results of which were, it is stated, completely satisfactory and the fuel consumption no higher than when utilizing high grade Diesel oil.

Combination Portable Drill and Grinder

A NEW portable combination machine for hand drilling and grinding operations has been developed by the Wodack Electric Tool Corporation, Chicago, Ill. The tool is so designed that the motor has the correct speed for both drilling and grinding. The drilling capacity is ⅛-inch to ⅝-inch holes in steel and when used as a grinder it is fitted with a 6-inch by ¾-inch wheel. The complete weight of the machine is 18 pounds and the motor under service develops ½ horsepower.

Boiler Scale Investigation.—The Bureau of Mines has undertaken, at the Pittsburgh Experiment Station, an investigation of the mechanism of scale formation in steam boilers. The object of the investigation is to determine if the character of the precipitates forming in boilers may be made to assume a form in which they do not attach themselves to the walls, and also to ascertain if the material in the boiler wall exercises any influence.

Effect of Vacuum Upon Economy in Marine Practice*

Vessel's Income Depends Upon Securing Maximum Ton Miles Per Ton of Fuel, Which Is Largely Influenced by the Vacuum Obtained

By Frank V. Smith†

As the income of a ship depends upon ton miles, it must also depend upon the speed of the vessel and the number of days actually at sea. Any condition that delays a ship in port, or delays its speed at sea, means just so many less ton miles and, therefore, less income.

An engineer is very apt to say that he cannot see that his job affects the income of a ship in any way and that the running of the ship, that is the executive end of it, is all done in the office and, therefore, all he has to do is to follow orders. We will consider one item to bring out more clearly why the engineer of a ship has a great responsibility and in what way he holds in the palm of his hand the making or breaking of the merchant marine.

Consider a turbine ship of the type that we are most familiar with—a 2,500 shaft horsepower turbine with double reduction gears. The power derived from a pound of steam depends upon the initial steam conditions, that is, pressure and superheat, or, taking the two items collectively, the total heat of the steam and the final pressure or vacuum. The difference in the heat content of the steam in its initial and final state, therefore, becomes the direct measurement of power. In a theoretical sense it does not matter what the initial and final pressures are as long as the same definite quantity of heat has been utilized and converted into power per pound of steam.

The steam consumption of a turbine, regardless of the power extracted by the turbine itself, is dependent upon the initial pressure, superheat and nozzle area. If we assume a case where the power derived from the same quantity of steam at the same initial pressure differs on account of the difference in vacuum obtained and know definitely how this power affects the speed of the ship, it presents an interesting analysis, for it directly affects the ton miles per year and, therefore, the income.

One Inch of Vacuum Equals About 75 Pounds of Initial Pressure

One inch of vacuum will roughly amount to from five to seven percent of the fuel, but do not think for one minute that this additional fuel is being used to make up for the loss in vacuum for it is not. With the loss in vacuum the fuel consumption is remaining the same, for the steam consumption is the same and will remain the same unless the initial pressure is increased to make up for the deficiency in vacuum so that the same pound of steam could liberate the same amount of heat. This, to my knowledge, has never been done on any of our ships. To make up for a loss of even one inch of vacuum it would be necessary to raise the initial pressure 75 pounds or more, and it is not at all likely that any engineer who has been in the habit of carrying a boiler pressure of 210 pounds gage would immediately upon the loss of one inch of vacuum raise the boiler pressure to almost 300 pounds. The fuel consumption is remaining the same as long as the initial pressure is the same and it simply means that there has been less power liberated for the same amount of fuel. Figured in terms of fuel per shaft horsepower hour, facts of this kind soon become evident in the analysis of the various reports.

Generally speaking, a typical cargo vessel, in order to pay operating expenses, with only a fair return on the capital investment, must average from 60 to 70 percent of a cargo when operating from 35,000 to 40,000 miles per year. Under this condition the average income should be, when figured on a knot basis, from $11.00 to $14.00 per knot, varying slightly with the valuation of the vessel. As a basis for future estimates on the value of vacuum, power and speed on a ship of from 7,800 to 9,000 tons deadweight carrying capacity a very fair average of $13.00 per knot will be used.

Assuming the same steam consumption, pressure and superheat and, therefore, the same fuel consumption, a variation in the vacuum will affect the power, speed and knots per year approximately as shown in the following table:

Effect of Vacuum

Initial pressure, 200 pounds, gage; 75 degrees F., superheat.
No. of nozzles open, 12.
Assumptions: (a) Designed speed of ship, 11.5 knots at 2,500 shaft horsepower.
(b) Value of ship at sea, $3,600 per day or $13.00 per knot.

Vacuum in Inches	S.H.P.	Knots per Hour	Knots per Day	Knots per Year 150 Days	Loss in Knots per Year	Loss in Dollars per Year at $13.00 per Knot
28	2500	11.5	276	41400	0	0
27	2285	11.16	267.84	40176	1224	$15,912.
26	2120	10.88	261.12	39168	2232	29,016.
25	1980	10.62	254.88	38232	3168	41,184.

Another interesting analysis would show that if the original vacuum of 28 inches was maintained instead of 27 inches the same power might be had with one-sixth less steam per hour or in round numbers about 5,000 pounds of steam per hour. This amount of steam per hour represented in terms of fuel, providing the boiler efficiency remained the same would be approximately four tons of fuel oil per day. If the oil was worth $12.00 per ton and the ship was steaming 150 days a year this would amount to $7,200 per year.

There are two ways then in which you might have saved money. The first was to get the better vacuum, therefore full power and speed, make a greater mileage per year which is the true representation of the ship's earning value and in the typical case shown represented nearly $16,000 per year in increased earning capacity, or in the second case get the better vacuum, shut off two nozzles, save five thousand pounds of steam per hour or four tons of fuel per day and amounting in a year's time to $7,200.

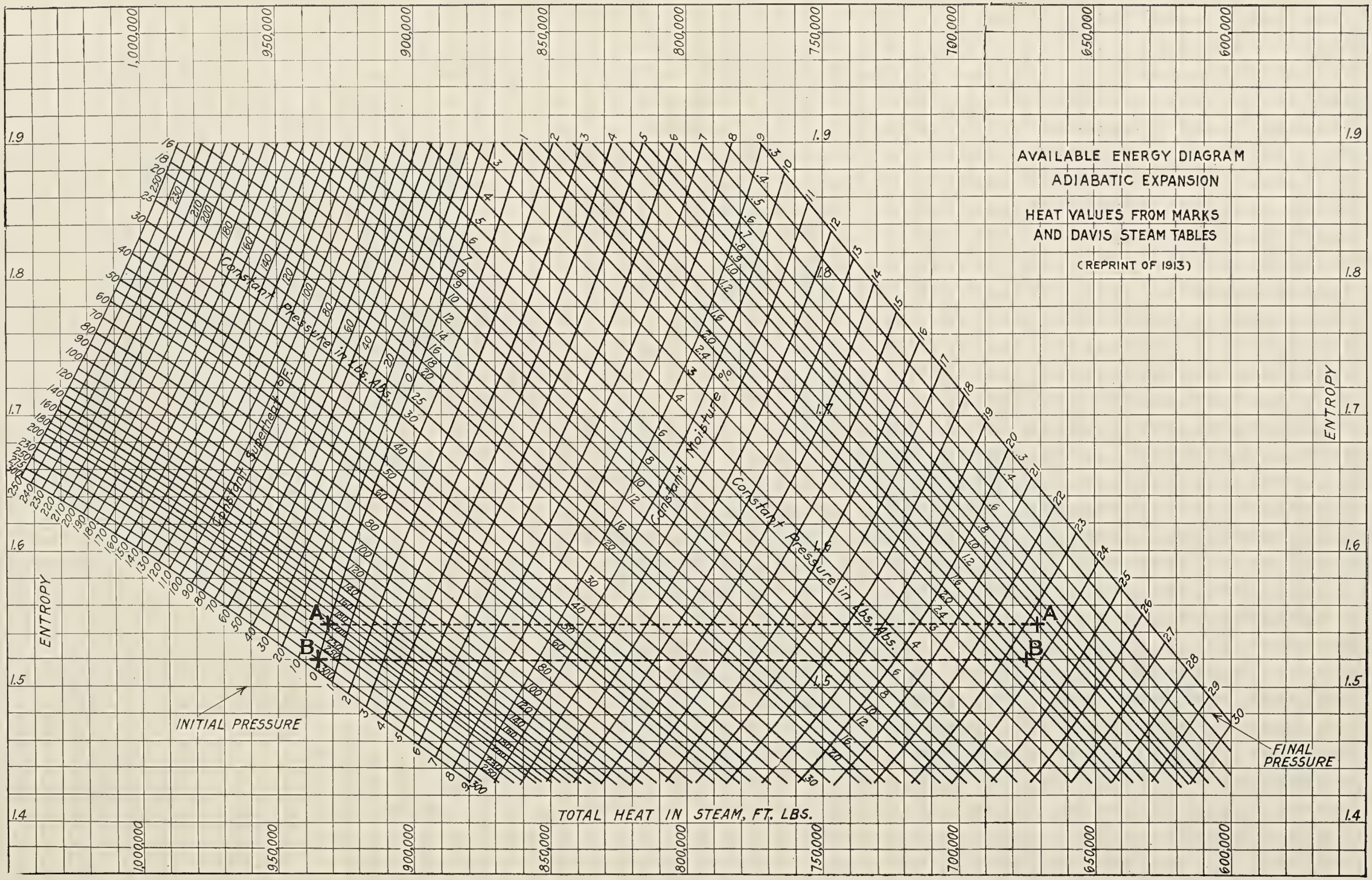
Value of Trained Engineer

You can readily see that in either case an engineer who does not fully understand the value of high vacuum in connection with turbine installations is a costly investment to any operating company. He not only wastes fuel that is worth more than his salary but also decreases the speed of the ship unnecessarily and places it in a field where it cannot possibly meet the keen competition of today, and which means either bankruptcy for the operating companies or the immediate tying up of the vessel to avoid loss. You have seen enough of the evidences of the latter movement so that it will not be necessary to go into the details regarding this feature.

When you consider the fact that if only ten men a year, who were trained at the Shipping Board schools, which were maintained at the various manufacturing plants, were successful in maintaining the proper vacuum on these ships that it would either increase the earning capacity of the same number of vessels $160,000 (an inch to the man) or result in the saving of $72,000 per year in fuel, you can gain some idea as to the value of a trained engineer.

*Abstract of paper read before a meeting of the Marine Engineers' Beneficial Association, New York, January 23, 1922.

†Marine Engine Department, General Electric Company, Schenectady, N. Y.



A—Initial Pressure, 200 Pounds Absolute; Vacuum, 28 Inches; Absolute Back Pressure, 1 Pound; Available Energy = 932,000—670,000 = 262,000 Foot Pounds
B—Initial Pressure, 275 Pounds Absolute; Vacuum, 27 Inches; Absolute Back Pressure, 1.5 Pounds; Available Energy = 935,000—675,000 = 260,000 Foot Pounds

Appendix

The mathematical calculations of steam are quite complex. As a general rule in turbine calculations the "Total Heat"—Entropy Diagram ("The Mollier Chart") is used and the work done graphically as far as possible. These charts are obtainable with Marks and Davis' "Steam Tables." In our work, however, we go a step further by using a chart in which the total heat is multiplied by the mechanical equivalent of heat (1 B.T.U. = 777.5 foot-pounds) in order that the result may be in foot-pounds and the theoretical water rate be more readily obtained.

Example: (1) Initial pressure, 200 pounds, vacuum 28 inches —(2) Initial pressure 275 pounds, vacuum 27 inches—are marked respectively "A" and "B" and worked out on the accompanying Available Energy Diagram and also by mathematical calculation.

Formula for Calculation of Available Energy

The formula for calculating the available energy of steam expressed in foot-pounds, either dry or superheated, when expanding adiabatically to any back pressure, is seldom found in handbooks or textbooks, and when such formulas are found they are rather complex and difficult to use. The formula can, however, be made very simple when expressed as the difference between the total heat input and the heat left in the liquid together with the latent heat in the mixture at the lower pressure. The formula then becomes:

Available energy in foot-pounds =

$$778\ [H_1 + C_p t_1 - (q_2 + x_2 r_2)]$$

H_1 = Total heat of saturated steam at intial pressure p_1.
C_p = Specific heat of superheated steam.
t_1 = Degrees F. superheat at pressure p_1.
q_2 = Heat of the liquid at lower pressure p_2.
x_2 = Quality of the steam at pressure p_2.
r_2 = Latent heat at pressure p_2.

All of these quantities are found in any steam table except x_2 (dryness factor) which is, however, easily calculated from the fact that the entropy is constant before and after the expansion.

Entropy of superheated steam is:

$$C_p \log_e \frac{T_1 + t_1}{T_1} + \frac{r_1}{T_1} + \phi_1$$

Entropy of moist steam is:

$$\frac{x_2 r_2}{T_2} + \phi_2$$

By making these equal and solving for x_2 there results:

$$x_2 = \frac{T_2}{r_2}\left(C_p \log_e \frac{T_1 + t_1}{T_1} + \frac{r_1}{T_1} + \phi_1 - \phi_2\right)$$

T_1 = Absolute temperature at pressure p_1.
T_2 = Absolute temperature at pressure p_2.
ϕ_1 = Entropy of water at pressure p_1.
ϕ_2 = Entropy of water at pressure p_2.

Available Energy of One Pound of Steam Expanded Adiabatically

Steam Conditions and Calculations

		"A"	"B"
1.	Initial pressure, lbs. abs.	200	275
2.	Total heat initial pressure, B. T. U., ...	1,198.1	1,202.9
3.	Entropy of steam, initial pressure	1.5456	1.5199
4.	Final pressure, lbs. abs.	1.0	1.5
5.	Total heat, final pressure, B. T. U.	1,104.4	1,110.5
6.	Heat of water, final pressure....	69.8	83.7
7.	Entropy of water, final pressure..	.1327	.1573
8.	Entropy of steam, final pressure..	1.9754	1.9417
9.	Entropy of complete evaporation = (8-7)	1.8427	1.7844
10.	Entropy of evaporation to condition at end of expansion = (3 — 7)	1.4129	1.3626
11.	Final quality = (10 + 9)	.765	.763
12.	Heat at end of expansion = 6 + [11 x (5 — 6)]	861.27	867.15
13.	Available heat (H_1 — H_2) = (2 — 12)	336.83	335.75
14.	Available energy in ft. lbs. = (H_1 — H_2) × 777.5	261,885.0	261,046.0
15.	Theoretical water rate per H. P. hour = $\frac{1,980,000}{(14)}$	7.6	7.6

16. Actual water rate per S. H. P.

$$= \frac{(15)}{\text{Turbine Efficiency}}$$

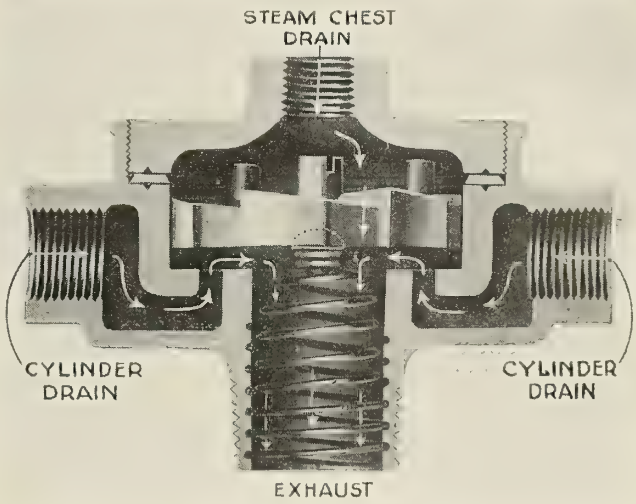
From the above calculations it is obvious that the amount of available energy that may be transformed into useful work in a turbine is practically the same in both cases (less than 1/3 of 1 percent difference and in favor of the lower initial pressure and higher vacuum).

All heat values were taken from Marks & Davis' "Steam Tables."

Automatic Drain and Relief Valve for Steam Reciprocating Equipment

For draining condensate and water from the cylinders and steam chests of reciprocating steam operated equipment the automatic relief valve being distributed by the Diel-More Sales Company, Inc., Philadelphia, Pa., has, in a wide application to equipment of this kind, tended to decrease the maintenance and repair costs by permitting the oil to function properly.

The valve is made entirely of brass and includes but one moving part—a self-grinding disk valve. The spring which supports the disk valve is adjustable, which feature permits



Sectional View of Automatic Drain and Relief Valve

considerable latitude in the pressure necessary to actuate the valve. When the engine or pump on which the valve is installed is at rest, the adjustable spring raises the disk valve thereby permitting the water to escape through by-passes to the waste pipe which eliminates the possibility of the operator neglecting to open the ordinary hand operated drain cocks after stopping the engine. Positive drainage is thus provided which prevents water remaining in the cylinder and freezing in the event of a shut down in cold weather. When the engine is operating, the disk valve is seated by the pressure carried in the steam chest (which pressure is constant).

The by-pass feature mentioned is claimed to be advantageous for direct connected engines (such as locomotives). With ordinary cylinder drain cocks exhausting hot air alternately to the atmosphere cold drafts of air are sucked in with each stroke of the piston. This air is objectionable and dangerous to hot cylinders, frequently causing warping or even cracking. Since the new valve does away with all ordinary drain cocks the liability of warping or cracking from this cause is also eliminated.

The valves are supplied with steam chest connections from ¼ to 1 inch diameter with either two or four parts and exhaust pipes from ½ to 1½ inches in diameter.

The Most Interesting Job in the Yard

Previous issues of MARINE ENGINEERING AND SHIPPING AGE *have contained letters from a machinist in the engineering department, an engineer in the engineering office, an engine erector and a draftsman in the hull department—all giving substantial reasons why their particular jobs are the most interesting in the yard. This month these claims are disputed by a ship joiner. How about YOUR job? Tell us about it.*

As a ship joiner, who served his apprenticeship in the shop, on the ship and in the drawing room, I would like to tell about the most interesting job in the yard—ship joinery. What could be more interesting than taking the rough lumber and fashioning it into beautiful and comfortable furniture for dining saloons, smoking rooms, staterooms, etc., for the passengers and at the same time turning the cold ship into a *home* for the men who "go down to the sea in ships?" There is so much to joiner work that I will briefly outline but a few things.

Starting first in the joiner shop drawing room (it may seem odd but joiners are proud of their draftsmen and consider them always as joiners), let us assume that the yard has a large passenger ship to build. The draftsman receives a plan of the arrangement of quarters, the specifications and all necessary reference plans, such as plans of steel deck houses, casings, bulkheads, shell plating, framing, decks, transverses, stanchions, heating and sanitary systems, fire mains, ventilation, sounding pipes and electrical plans.

In the Joiner Shop Drafting Room

As an example, let us take a public room, say the smoking room, and draw the deck plan of the ship to scale, say three-quarters of an inch to the foot. After we have laid down the center line and outlined the steel bulkheads and casings around this room, we spot the stiffeners and figure on fastening our furring. Then we can indicate the tongued and grooved lining and decide on the size of the room, face to face of the lining.

We next work up the different sections through the room to find interferences, such as brackets, girders, pipes, etc. Then the design of the room is laid down, always bearing in mind to work in with all piping and ventilator systems, and the electrical wiring, etc. We work the cornice over the steel brackets, unless the brackets are too large and spoil the design. In that case we get the hull men to cut the brackets out on a curve, which does not impair the strength, and also makes a better job of the joiner work.

The girders we case in, bearing in mind that all steel work must be covered so that a person on coming into the finished room sees everything in line and symmetrical. The windows, likewise, will have to be located to suit the joiner work. We always work as near to the steel plans as we can; then fight with the hull drawing room to have a stiffener shifted, if necessary (on the plan, never on the ship).

Now we are started and each section of panel work, the columns, cornice, beams and girder casings, moldings, tongue and groove, furring, window and door trim, sash, screen, blinds, doors and furniture are detailed, each on a separate sketch and sent through the shop to be manufactured.

These sketches first go to the shop leader, who lists all material, and then the lists go to the cut-out sawyer, who cuts out all material in the rough, then to the jointer, planer, sticker or lathe, according to the operation to be performed, then to the layer out, who lays out the lumber for mortising, tenoning, ploughing, rabbeting, fluting or carving, or to be glued up, then to the various machines, then to the sander or scraper, then to a bench hand to be assembled, hand sanded and scraped, then to the hardwood finisher or painter for the finishing. Finally, the hardware is installed in place, if called for.

Now the finished material is ready for the ship. We go out on the ship with steel tape, chalk line and camber board—checking up the steel so as to get the joiner work installed *exactly*. We find that the room is about 1½ inches smaller in length than the steel plans called for—the deck has sagged in places. Now we have to use our heads for the finished room must be correct, so we take up (steal, the joiners say) a little here and a little there until the panel work, cornice, etc., line up so fair that even the old time joiner inspector, who squints one eye and swears he can see anything fifty feet away that is out of line one-sixteenth of an inch, passes the room as O. K.

The Work on the Ship

The room is now shaping up and beginning to look good. You have a force of say twenty joiners in this room. You know what every man is capable of doing and what particular work he can best perform. The old joiners are expert in all the work, and so are some of the young ones, who served their apprenticeship before the war. You put Bill at fairing up the cornice, Joe at hanging doors and Tom at fitting sash and screens. You notice with pride how neat and efficient they are at work, how Bill never hits the moldings without using a block, how careful Joe is that he does not split out the wood when he cuts out for the lock and hinges and how particular he is that the slots in the screw heads line up so they will not annoy the eye of a good joiner when he sees them. And there is Tom just taking enough off the sash or blinds so they will not rattle and annoy the passengers and at the same time give them enough clearance so they will work. Every piece of wood seems to have life. The men take pride in their work. They would sooner lose a finger than have it said their work was not right. It is the most interesting job!

The Critics Arrive

It is noon. The men sit down and eat their lunch right on the job. Between bites they glance around the room to see if their work looks perfect from other points of view. The crowd starts in to see the joiner work—a couple of draftsmen or clerks from the main office, here a riveter, there a bolter or driller, a few machinists and plumbers, a ship carpenter and electrician. It is interesting how it draws all of them.

You slip away to make up your time book and meet the other foremen and you just have to say what a good joiner Low is or Charlie is.

(And Mr. Editor, if this article is printed, it will be the first time to my knowledge that any article about "Ship Joinery" was printed, as ship joiners, for some reason, will never write anything about their trade. It is a secret art. During the war, thousands of men worked at ship joinery and now they think they are joiners—but it takes the "old timers" to build an elliptical front paneled pilot or deck house, and to develop the sills and plates, moldings, paneling, sash, etc., where they have camber, sheer, rake and a radius all running together, or to build the fancy wooden skylights, etc., they used to build.) I trust that the old joiners will forgive me for writing this—but let us hope that this will wake " 'em" up, so they can mark time with the iron trades and finally pull ahead. JAMES T. STRAHAN.

West Collingswood, N. J.

Ferryboats Can Be Operated On More Economic Basis

Outline of Method and Sketch of Arrangement of Machinery for Eliminating Waste on Double Ended Boats

By H. Schreck

THE uneconomical propulsion of double ended boats led the writer to make a careful study of this condition, which finally resulted in a device which will eliminate the waste of power encountered on the present day arrangement of these boats. This problem has for years been a subject of calculations and tests in order to establish the amount of said waste of power.

This type of boat is in general laid out with one triple expansion engine or two compound engines in tandem arrangement in the middle body of the boat. The shaft runs to each end of the boat and carries one propeller at each end; one of these propellers pushing the vessel ahead and the other pulling the boat. When the boat is reversed the engine is reversed and in turn also the respective working of these two propellers. Some boats are driven by two through shafts in which case the above described plant is simply duplicated.

It is well known that the low propulsive efficiency of these boats is due to the dragging of the forward screw and to the hydrostatic pressure of the water column, which the forward screw builds up on the bow and on a great part of the forward length of the hull. It is readily seen that in this manner a large part of the energy which is put into the forward screw is very largely lost and the output of the engine must be increased by the amount of said increased resistance of the boat in comparison to an ordinary ship with one screw aft.

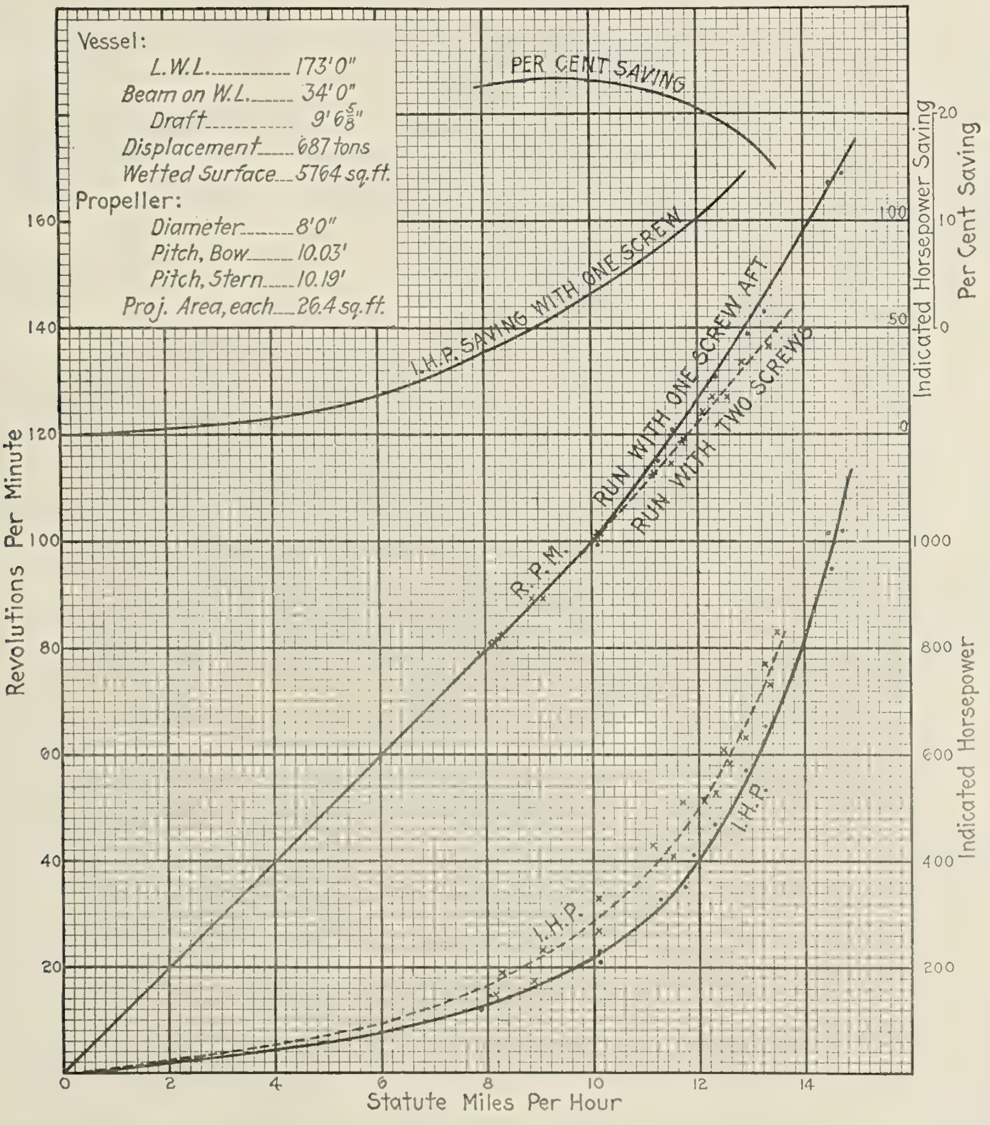
Tests

The experiments and calculations, to which reference was made in the introductory paragraph, have been carried on in an elaborate and painstaking manner on many existing ferryboats by prominent engineers for the past twenty years, and the studies by such men as F. L. DuBosque, Col. E. A. Stevens, Commander S. M. Robinson and others will remain of permanent value to the marine engineer.

In the accompanying chart the results of the progressive trials of the *Edgewater* were plotted from the test sheets, which were made and published by Col. Stevens in 1902 in the Transactions of the Society of Naval Architects and Marine Engineers. These tests were run in three ways: first, with both screws in place, one forward and one aft; second, the forward screw removed, the boat being pushed only by the aft screw; and third, the aft screw removed, the boat being pulled by the forward screw. The latter results are not plotted in the chart on account of the extreme losses and because they are of no commercial value.

Although this chart hardly needs any explanation, it may be shown by one example how to read the chart. Assuming the boat is to run twelve miles an hour, we follow the twelve-mile line and find that at this speed the vessel requires, when driven by two screws, 502 indicated horsepower and driven by one screw 400 indicated horsepower, which would mean for the latter case a saving of 20.3 percent.

These losses or waste of energy will, of course, vary on various ships with the shape and speed of the vessel and location of the screws in relation to the hull and the characteristics of the propeller. A few other results may be quoted as follows:



Results of Progressive Trials of Ferryboat Edgewater

Line — and points designate I. H. P. when boat is driven by screw astern only.
Line - - - and crosses designate I. H. P. when boat is driven by screw ahead and astern.

On the *Cincinnati,* of the Pennsylvania Railroad, the loss of power due to the forward screw at eleven miles speed was measured to be 20 percent. The results of another ferryboat were published in the December, 1920, issue of this paper. At a speed of 12.75 knots an increase was required in effective horsepower, due to the forward screw, of 37 percent and an increase of total indicated horsepower of 23 percent. In the May, 1921, issue of *Pacific Marine Review,* the tests of a large ferryboat on the Pacific Coast were published. This boat required at a speed of 14.77 knots, with both wheels, 3,010 indicated horsepower, and with the forward wheel taken off 1,740 indicated horsepower, which represents in the latter case a saving of 42 percent.

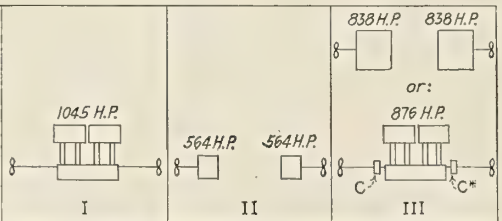
Suggestions have been made and followed out to overcome this waste by using a propeller without backing power. Propellers which embody this demand, as much as possible, are running on some ferryboats. It is claimed, however, that the maneuvering of the boat is very unsatisfactory.

Trend of Eliminating this Waste

There are three characteristic methods of propulsion of double ended ferryboats and in illustration some of the figures of a previously mentioned publication by Commander Robinson will be utilized.

If we consider his boat of 191 feet length, 44 feet beam, and running at a speed of 10 knots, the total towing power with two screws of 680 effective horsepower and with only the after screw 496 effective horsepower the following three arrangements may be investigated for this boat:

1. The present day arrangement, that is, one main engine.
2. Two motors, each transmitting about half of the power. However, each one can be turned at its respective most favorable speed.
3. Two motors, one at a time transmitting the full power for pushing the boat, while the other motor turns the screw over at about the speed of the boat, but without doing any work. This condition is reversed for running the boat in the other direction.



	I		II		III	
Screw	Aft	For'd	Aft	For'd	Aft	For'd
R.P.M.	116.9		114.7	119.8	131	117
I.H.P.	656	389	564	460	838	38
I.H.P. Total	1045		1024		876	
Gain over I					16%	
Gain over II					14.5%	

* Clutch

It can be readily seen that the gain of case 2 over 1 is very little, which is evident from the fact that in case 2 the forward propeller still throws the column of water against the bow of the vessel. A marked gain in propulsive efficiency is, however, made in case 3, in which the forward propeller does no work, but is merely turned over. The turning will require only about 4 percent of the power, as it is only necessary to overcome the frictional resistance of the propeller blades and of the shafting.

This arrangement is, as to propulsive economy, practically equal to an ordinary ship with the screw aft. The first cost is, of course, very much higher since it requires two full power motors and in addition a generating set, and the overall efficiency is lowered by 15 to 18 percent of the power due to the electric transmission by generator and motor.

A part of this electric loss is offset by the fact that the generator set can be a high speed turbine, which works more efficiently than the reciprocating steam engine. With this arrangement Diesel engine generator sets would produce far greater substantial saving.

Suggestion of the Writer

In order to accomplish the maximum propulsive efficiency, the writer suggests an arrangement which will combine the advantages of cases 1 and 3 at the smallest cost of installation and the possibility of building it in on existing boats (a patent on this combination is pending).

The suggestion is to interpose a clutch at each end of the main propelling unit between same and the two propeller shafts. This clutch, which may be a magnetic or hydraulic one, will allow varying the power transmitted and the speed of the after shaft in relation to the forward shaft; that is, when the boat is going ahead almost the full power of the main engine will be transmitted to the aft screw, while the forward screw will be merely turned over at about the speed of the boat, but without doing any propulsive work. Clutches that fulfill the above requirements have been investigated and are being built.

Expected Savings

An example may be cited which will allow the reader to form a conception of the savings which can be effected by providing a ferryboat with the suggested improvement. Taking, for instance, a ferryboat of 1,400 indicated horsepower, the following results may be obtained:

Thirty percent saving in propelling power = 420 indicated horsepower. Assuming the boat to run 10 hours a day for 300 days of the year. Take the cost of coal at $9 per ton and the coal consumption, including auxiliaries, at 2 pounds per indicated horsepower.

$$\frac{420 \times 2 \times 10 \times 300 \times \$9}{2,240} = \$10,120$$

Reduced cost in handling of coal and reduced boiler repair bill, estimated	3,500
Saving per year..............	$13,620

It will be noticed, that the estimates are made very conservatively. The saving of 30 percent is taken as an average of actual tests. Also 10 hours' operation is very little, since most ferries run for 14 to 16 hours and some of them for 24 hours. Very conservative also is the figure of 2 pounds of coal per indicated horsepower for compound engines, but the writer has tried to make all his statements as carefully as possible.

National Foreign Trade Council Urges Adoption of Hague Rules

American shipowners and operators are urged by the National Foreign Trade Council to issue, as soon as possible, bills of lading drawn in conformity with the Hague Rules, 1921. The following statement represents the views of the executive committee of the council, of which Mr. James A. Farrell, president of the United States Steel Corporation, is chairman.

"The committee believes that these rules embody as favorable a readjustment of the distribution of liability between shipper and carrier, as can at present be secured. While fully cognizant that these rules do not satisfy many of the demands of shippers, the committee is of the belief that their adoption will constitute a substantial step in the right direction and will, in fact, confer very real benefit on the foreign trade of the United States."

Deck Coverings

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

THIS article is concerned with special forms of deck covering that are frequently met with. It is not concerned with the usual run of wood decks, canvas, paint, or those bituminous coatings whose principal purpose is to act as a preventive of corrosion. As a number of the deck coverings are put forth under trade names which do not clearly define their character, such names of American products as the writer has come in contact with will be presented in order that the reader may be advised as to what class of product they belong. No attempt will be made to compare proprietary coverings of the same nature with one another.

Ship specifications generally state the types of deck covering that are to be used in various locations, but there are usually a variety of points to be considered before the specific covering is finally determined upon. In making these determinations classification society requirements should not be overlooked.

The principal points to be considered in the selection of deck coverings are below listed, and the type determined upon for any location should be the one which is best in those features that are of most importance for that particular service and for the main governing circumstances. The preparation of a typical schedule of general application is impossible.

Weight
General durability
Appearance
Wearing qualities
Resiliency
Waterproof and sanitary properties
Non-slippery
Quietness
Warmth
Cleanliness
Fireproof
Probability of failure
Cost

In laying deck covering it can be stated as a general requirement that the deck should be absolutely dry and clean, and free from scale, oil or other foreign matter.

Alundum Tile

See "Tile" Class (b). This tile is particularly slip proof.

Asbestolith

See "Composition."

Beaver Tile

See "Cork Composition Tiling."

Bitucrete

See "Bitumen Deck Coverings" Class (c).

Bitumen Deck Coverings

These are heavy coverings for hard usage such as the truck ways of ferryboats or on troopships. The material is also of value for the bottom of chain lockers. They are of four general classes and various special types all of which have asphalt as the binder. Asphalt is a black bituminous hydrocarbon, semi-fluid to hard in consistency, which is the heavy residuum from some petroleums or occurs naturally. As made up for use it is usually called asphalt cement. The four usual classes of covering are:

(a) What is commonly known as asphalt, which is a mixture of native or prepared asphalt cement and stone dust.
(b) The same as (a) but with larger stone, slag, coke or other aggregate in it.
(c) A covering made by coating the deck with the pure asphalt cement and then laying down a layer of hot stone which draws the asphalt up through it.
(d) A covering made by the use of cork bricks, bituminous bricks or other material of that nature laid in the standard bituminous solution and enamel coating and with the enamel poured between the cracks and over the top, and the top sanded.

In all four cases the deck should be first coated with a bituminous paint as a binder, and with class (c) a 2-inch mesh wire fabric welded to the deck is desirable.

Class (a) is laid hot, sanded on top and rolled or tamped, then the excess of sand is brushed off, Portland cement is sprinkled over the surface, and it is again rolled or tamped. The composition is usually about—

Asphalt cement	10	percent
Stone passing 200 mesh	13	percent
Stone passing 80 mesh	23	percent
Stone passing 40 mesh	27½	percent
Stone passing 10 mesh	26½	percent
	100	percent

It weighs about 102.5 pounds per square yard per inch of thickness.

It can also be laid upon a bottom course containing still less asphalt and with stone up to one mesh in size, or can be laid on a backing of other material.

Class (b) material is also laid hot but some of the mixtures do not require rolling. It can be made lighter than class (a) by using coke or other light aggregate. The stone in class (c) is usually small, up to ⅛ inch and the coating is rolled.

Bitumen deck coverings demand an asphalt cement of high melting point, ductility and cementing power and low penetration, the latter being a measure of the distance a weighted needle will sink into it during a specified time at a specified temperature. It also demands skilful mixing and laying. If not of proper quality and well laid, it is subject to cracking and pulling away from bounding angles, etc., to disintegration, scaling and very easy marking and displacement. It is always subject to cracking when not in constant use because there is a gradual passing off of volatile matter which results in the materials soon becoming dead unless the surface is kept alive by the traffic over it.

An asphalt deck covering was developed by the Concrete Ship Section of the Emergency Fleet Corporation which called for the use of an asphalt cement having a melting point from 104 to 140 degrees Fahrenheit, a penetration of 80 to 90 at 77 degrees Fahrenheit, 100 grams, 5 seconds, and which did not specify the ductility. The covering was made from this asphalt and stone particles 100 percent of

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

which would pass a $\frac{1}{4}$ inch sieve and not over 5 percent of which would pass a 100 mesh sieve. It was found to be too soft and the specifications were revised to call for an asphalt having a melting point from 135 to 150 degrees Fahrenheit, a penetration of 40 to 60 and a ductility of not less than 20 centimeters. The sand was as before and a mineral filler was called for of any fine material such as Portland cement, limestone dust or silica, 85 percent of which would pass a 100 mesh screen. The requirements with regard to mixing and application were:

Formula for mixing—Asphalt cement—10 to 15 percent
Mineral filler 20 percent
Sand or other aggregate 70 to 65 percent

The sand or the mixture of the sand and mineral filler and the asphalt cement shall be heated separately to about 300 degrees Fahrenheit and when the aggregate is dry and the asphalt cement completely fluid, they shall be thoroughly mixed. If limestone dust is used, it shall be mixed cold with the hot sand just before incorporating it with the asphalt cement.

The hot mixture prepared as above shall be spread on the deck previously coated with a priming coat which has become tacky and shall be smoothed out with suitable hot iron and rolled. Before rolling, the surface should be sprinkled with Portland cement or limestone dust.

The properties of natural asphalts and typical asphalts from Mexican and Californian crude oils are of interest in this connection. Pennsylvania crude is a paraffin base oil and cannot be made to produce asphalt.

	Natural		Oil	
	Trinidad	Bermudez	Mexican	Californian
Bitumen, percent	56.0	94.	99.5	99.5
Mineral matter, percent	36.8	2.	.3	.3
Melting point, degrees F.	190	180	140	140
Penetration	.5	2.5	55	40
Ductility			45 cm.	2 cm.

The natural asphalts are considered to be the best. They can be modified to have any desired penetration, with corresponding change in the other properties. In some cases the melting point of oil asphalts is raised and the penetration lowered by blowing air through them during manufacture but this is at the expense of ductility and cementing power, and such asphalts are of no value for flooring purposes.

Breylite

See "Bitumen Deck Coverings." Class (b). This coating with a stone or slag filler weighs about 27 pounds per square foot, $2\frac{1}{2}$ inches thick.

Brick

The use of brick as deck covering is confined principally to the galley, oven rooms, etc., and red pressed bricks are most favored. They are laid on Portland cement thick enough to take care of all irregularities and also to have sufficient body in itself to keep from breaking up.

Brick Tile

Brick tile are used where bricks are used, and also in pantries, bar rooms and other locations where frequent washing is desirable and where bricks are not quite good enough.

Their wearing qualities are shown in the comparative table in the section on "Composition."

They should be laid in Portland cement, a 1 to 2 mix, about $1\frac{1}{2}$ inches thick, and grouted with Portland cement grout.

Cement Deck Covering

This is a mixture of Portland cement and sand and as a complete covering is of principal value in crews' washrooms and toilets, laundries, sculleries, storerooms and similar service.

The surface under wear produces a fine powder. Surface waterproofing compounds can be used to harden the surface and reduce this trouble, but are not required for the usual shipboard service of this covering.

As will be seen from the wear resistance table in the section on "Composition" a mixture of one part cement and one part sand is most desirable. When used in connection with a surface covering of some material a mixture of one part cement to two parts of sand will usually answer. The Navy Department requires a 1 to 1 mix under tiling.

This deck covering weighs about $12\frac{2}{3}$ pounds per square foot per inch of thickness.

Composition

A deck covering which is essentially a magnesium oxychloride cement is designated as a composition deck covering. It is one of the best and, therefore, extensively used.

The most valuable features of a composition deck covering are that it is durable, sanitary and vermin proof, free from splintering and from the sanding out that is frequent with Portland cement, allows of good color effects and beauty of finish, and is non-slippery. This material is also of relatively light weight and is watertight when in good condition. It is comparatively noiseless to the tread and quite efficient as a thermal insulator.

The chief disadvantage of a composition deck covering as developed to date is that it does not retain its strength and soundness when subjected to continued wetting, that it cracks when subjected to the excessive heat sometimes found above boiler rooms and other heated spaces, that, if there is any excess of magnesium chloride in it and water penetration between it and the steel deck, rapid corrosion of the steel will result, and that it does not bond firmly to smooth steel plates. For these reasons one of the classification societies during the height of the wartime shipbuilding activities sent out the following excerpt from their published rules to deck covering manufacturers:

"Deck Composition may be laid on steel decks which are not exposed to weather, excessive moisture or heat, provided the material is not destructive to steel or is effectively insulated from the steel by a non-corrosive protective covering, which is proof against attack by chlorides. Samples taken from the composition by the surveyors, while it is being laid, are to be subject to independent analysis at the cost of the manufacturers. The steel plating is to be thoroughly cleaned with alkaline solution before composition is laid. Large areas of deck are to be divided by cabin sills, angles, etc., or holdfasts are to be fitted not more than 3 feet apart."

Roughing up the steel deck or curling up chips of it, with air tools, is allowed by the classification societies in lieu of the above mentioned holdfasts, but the latter have much to commend them. The non-corrosive protective covering referred to, which is generally recommended by classification societies, consists preferably of two coats of a bituminous solution that will permanently adhere to the steel deck without cracking. With some makes of composition this covering is definitely required. In locations where the composition would be exposed to excessive heat, if laid in the usual way, it can be used with safety by the interposition of a layer of cork slabs between it and the steel, the steel first being coated with the above mentioned bituminous covering. It is held down by properly placed holdfasts extending above the cork.

On wood decks the practice is to lay down heavy insulating paper over which expanded metal or heavy galvanized poultry wire is securely nailed. The composition is then applied.

Reliability of Manufacturer Important

The writer is of the opinion that the best specifications for composition deck covering which can be devised will not safeguard the shipbuilder and owner like *the selection of a manufacturer whose product has been proved to be good*

and who has a reputation to maintain. A selection of the material on a competitive price basis alone, under such specifications as are usually met with, is suicidal. This may be readily seen by those who are sufficiently interested to follow along with the discussion of this material, which includes many of the findings and the conclusions derived therefrom of the Dow Chemical Company of Midland, Mich., which has done a vast amount of very valuable research work on this product for use both as stucco and as floor covering.

True magnesium oxychloride cement without the special ingredients required for floors consists of:

Aggregate, which is usually "silex" or powdered silica, crushed from quartz and consisting almost entirely of sharp and irregularly shaped particles.
Sand, relatively fine.
Calcined magnesite, powdered.
Magnesium chloride solution.

The aggregate, sand and magnesite are first mixed together in the proper proportions and then sufficient magnesium chloride is added to produce a material of the right consistency. This combines with the magnesite to form magnesium oxychloride which then acts in the same manner as Portland cement acts in Portland cement concrete. Magnesium chloride may be dissolved in water to form a solution of any strength from zero to 36 degrees Baumé, at which point the solution is practically saturated at 70 degrees Fahrenheit. At this temperature one gallon of 22 degree solution will contain approximately 4½ pounds, and one liter will contain approximately 530 grams of solid fused chloride. It is not safe, however, to depend upon any weight-volume ratio when making up a solution; it should be tested with a hydrometer that is accurate and easily read. The Dow Chemical Company has adopted a method of determining consistency by use of a series of flat ended rods of equal weight but of widely varying diameter which are applied to the surface of the deck covering immediately after mixing. Standard consistency is set by them at the point where a No. 20 rod (250-gram, 1¼-inch diameter) just fails to enter the product. This closely duplicates the consistency of the best deck covering practice.

The silex is what is known as a 120 mesh silex (95 percent to 100 percent passing a 120-mesh screen), and one sample tested by the Dow Company and considered by it to come very close to meeting the theoretical and practical requirements of the average sand to which it is to be added as a void filler had 54 percent passing a 200-mesh screen, another 41 percent passing a 120-mesh, and the remaining 5 percent passing an 80-mesh. If the silex or other aggregate is too fine difficulties will be encountered as will be seen later.

According to the Dow Company the ideal sand is one of which one-third will pass an 80-mesh screen but be retained on a 120-mesh, another third will pass a 40-mesh, and the balance will pass a 20-mesh; or one of which one-fourth will pass an 80-mesh screen and be retained on a 120-mesh, another fourth pass a 40-mesh, another fourth pass a 20-mesh, and the balance pass a 10-mesh. A commercial sand 90 percent of which passes a 20-mesh screen may be expected to be of about the proper fineness.

Composition of Magnesites

The composition of commercial magnesites varies within wide limits. The Dow Company gives the following as the average of a large number of commercial magnesites tested by it in 1919 and states also that it believes this to represent a satisfactory grade as far as chemical composition is concerned. To total up 100 percent the quantities will have to be all slightly reduced.

Ignition loss	5.0 percent
Silica	6.0 percent
Iron and aluminum oxides	1.0 percent
Calcium oxide	3.5 percent
Carbon dioxide	2.5 percent
Magnesium oxide	84.5 percent

It is necessary that the magnesite be properly calcined and not under burned or over burned.

The average fineness of commercial magnesite is about as follows:

Passing 100 mesh	95 percent
Passing 150 mesh	86 percent
Passing 200 mesh	76 percent
Passing 275 mesh	42 percent

Chemical analysis is an entirely satisfactory guide to the quality of magnesium chloride and definite specifications for it can be written on the basis of chemical analysis alone. The Dow Company advertises its magnesium chloride as averaging less than one percent of salt and of calcium chloride and containing only a trace of sulphate. The 22-degree solution has been taken by the company as the standard for use in oxychloride cements, as it has found that the mechanical strength, water resistance, abrasion resistance and all related factors are dangerously affected by the use of weaker solutions, that most good magnesites are thrown into the doubtful class and medium or poor magnesites are worthless when used with 18-degree solutions, and that trowelling troubles should be eliminated by the use of a slower setting magnesite instead of uselessly trying to patch up bad properties with the use of lower solution strengths, reserving the rapid setting magnesites for use in cool weather. They have found that solutions of 24 or 26 degrees Baumé may be recommended for use with magnesites which do not have marked expansive characteristics and which are velvety instead of sandy in texture and that while sandy textured magnesites produce products which are prone to sweating and efflorescence when made up with 26-degree or stronger solutions, the use of 22-degree or 18-degree solution is not a secure protection from these undesirable properties in their case.

Other Ingredients

With most of the ingredients outside of the magnesite and the magnesium chloride the physical properties are of much greater importance than the chemical composition.

While a true magnesium oxychloride cement of the mixture before given is very good for stucco it will not answer for deck covering on account of the demand for resilient treading, hardness, a fine finished appearance, color, etc.

Nearly all deck covering compositions contain 8 to 10 percent of color pigment, about the same amount of powdered talc, or soapstone, the latter being an aid to trowelling, and a like amount of fibrous binder filler. The amount of silex added depends upon the degree of hardness and wearing resistance desired, the larger amounts giving the harder floors. A floor of average hardness would contain about 25 percent of silex, which gives a total of about 55 percent of fine aggregate, silex, talc fiber and pigment. The calcined magnesite is usually at least 45 percent, which is much in excess of the amount necessary to fill the voids in the fine aggregate but desirable for fine finished appearance and resilient treading. The amount of fiber present is small in weight but relatively large in bulk. It is mineral or ligneous. The mineral fiber, asbestos, may be obtained in various lengths or grades, each of which finds preference by one or another of the deck covering manufacturers. The wood fibers are used either as sawdust or as pulverized wood flour of varying degrees of fineness.

The principal requirements of a composition deck covering are:

1. Strength
2. Good wearing qualities
3. Freedom from excessive expansion and contraction
4. Watertightness
5. A setting time that will allow of proper handling
6. Permanency and uniformity of color
7. Freedom from excessive sweating and efflorescence

8. Good surfacing qualities
9. Sufficient thickness of coating

Most of these requirements demand properly calcined magnesite of suitable analysis, pure magnesium chloride and good materials throughout, uniform mixing and skilful laying; but there are a number of factors which particularly affect the different properties, that illustrate what a complex problem the manufacturer of composition deck coverings has on his hands, and which we will now consider under the respective headings.

Strength

Good strength is an indication of good magnesite quality. The tensile strength of deck covering composition should be at least 500 pounds per square inch when seven days old. The compressive strength will be about four times the tensile strength. The modulus of elasticity of the average deck coverings on the market is in the neighborhood of 1,000,000, and this allows of a contraction of about .05 percent before reaching a stress of 500 pounds per square inch.

Tensile, compressive and cross bending strength tests are all important. The compressive test is more reliable than the tensile with high strength materials on account of the difficulty in securing uniform stress when testing briquettes. The cross bending test is closer to operating conditions than the straight tension and compression tests, and allows of the determining of the elastic properties of the material in comparatively simple fashion. On account of trowelling, the structure of the surface is different from that of the material beneath it; and this has led to the development by the Dow Company of a special type of test bars, approximating the structure of the material as actually used, which are tested by this method.

Proper grading, which is principally a matter of void filling, is a strength factor. There should be no large voids as the magnesium oxychloride binder, like glue, is of maximum value only when in a thin film. The sand used should be clean and pure, and free from organic matter and mud.

As previously stated the magnesium chloride solution should be 22 degrees Baumé or higher. A solution of any strength between 14 degrees and zero does not produce a true cement, a 16-degree solution is but little better, and an 18-degree solution gives only 50 percent of the strength that the deck covering can attain with use of a 22-degree solution. There is a steady but less rapid increase in strength of the covering with increase in strength of the solution above 22 degrees. Notwithstanding this fact some contractors allow the use of weak solutions under the impression that a degree or two makes no difference, leaving the matter in the hands of ignorant or incompetent workmen equipped with inaccurate hydrometers or those that are difficult to read. There is also a temptation to stretch out an insufficient supply of solution by adding water to it. Specifications and working directions should call for the use of at least 22-degree solution. By using stronger solutions less magnesite will be required for any given strength of the resultant product; and the actual volume of solution needed to produce a given stiffness of mix decreases steadily with increase of chloride solution strength.

Excessive amounts of chloride solution reduce the strength, although wet mixes show somewhat higher strength after being wet and dried again than those of normal consistency. This last is fortunate as the tendency, to make the work easier, is to apply the material in a condition wetter than it should be.

The use of an aggregate of impalpable fineness such as Kieselguhr results in inferior strength.

Wetting decreases the strength and a mix which gives high strength when tested dry may lose all of its strength on being wet, while another originally weaker will stand up better. Some workers with this material feel that the use of 18-degree chloride results in a superior product as regards water resistance to that when 22-degree chloride is used but tests made by the Dow Chemical Company show the contrary to be the case. These tests, however, have led them to the conclusion that the water resistance, or the strength after having been subjected to wetting, of any particular oxychloride cement will be found to be a function of the amount of chloride used.

Furthermore compositions produced by some magnesites, which stand at the top of the list as regards strength when dry, are much inferior when wet to those produced by other magnesites which give decidedly less dry strength to the product. It is essential that the deck covering manufacturers study the water resisting properties of the magnesites they purchase, for some of them give cements so little resistant to water that trouble is almost sure to result from their use. The Dow Company believes that the cause of the variation lies more in the burning than in the chemical composition of the magnesite. Commercial products can be secured which give cements of very high water resistance, and a study of this one point will greatly lower the chance of failure of composition deck coverings as well as possibly opening the way to a wider field of usefulness.

Wearing Qualities

A composition deck covering should have good abrasion resistance as well as good wearing resistance. The former has to do only with the scratching or marring of the actual surface but depends upon the same factors that affect the wear, with possibly an accentuated effect of the trowelling. Abrasion resistance is also increased by the use of a highly fibrous base or scratch coat, which increases the resiliency of the product. A uniform covering throughout is much to be preferred, however, if working conditions about the ship are going to delay the application of the finish coat of a two-layer job so long that it cannot make a proper bond with the scratch coat, or if the other work being carried on results in getting oil, grease and similar materials on the scratch coat.

The majority of composition deck coverings are designed for resiliency, easy treading and highly finished surfacing qualities; some are made harder with resultant loss in resiliency; and for the maximum amount of wearing resistance there is the oxychloride artificial stone flooring. If woodwork has to be screwed to the composition, it must be made relatively soft, and this can be accomplished without making the material porous.

On account of the impractibility of selecting any one of the types of oxychloride flooring as a standard of wearing resistance for comparison with other coverings, the Dow Chemical Company selected clear, well seasoned maple flooring for this purpose, it being more uniform in its properties than any other readily available flooring. Rating this at 100 they found by careful test the following relative immunity-to-wearing values:

Oxychloride heavy duty flooring (average of 8 prepared samples)	414
Hard white porcelain tile (mosaic)	233
Common red tile (hard, unglazed)	164
Inlaid linoleum (best grade)	147
Inlaid linoleum (medium grade)	113
Semi-hard oxychloride flooring (average of 4 submitted samples)	103
Hard maple flooring	100
White oak flooring	88
Asphalt mastic	73
Hard yellow pine flooring	63
Oxychloride composition flooring (resilient type)	
Average of seven submitted samples	51
Average of ten prepared samples	47
Portland cement (1:1 mix)	43
White marble slab	28
Alberene stone	16
Portland cement (1:2 mix)	14
Portland cement (1:3 mix)	11
Printed linoleums	1 to 10

The prepared samples of composition were of a flooring mix which closely approximates the average properties of the usual commercial composition deck covering. They were made with magnesites of normal setting time and tested at fourteen days' age.

There is no dependable relation between wearing resistance and tensile strength. It would therefore seem advisable for deck covering manufacturers to add a comparative wearing test of some kind to the other physical tests they make of their product.

The wearing resistance of the average deck covering is roughly proportional to the amount of magnesite in the mix. It is therefore dangerous to lower the magnesite content for the purpose of economy. Compositions designed for hardness rather than for resiliency may, however, have much greater wearing resistance than the average deck covering notwithstanding a much lower percentage of magnesite.

Some floors are found to resist wear more than twice as well as others when the only difference in them is the particular magnesite used.

The nature of the fiber used has a bearing upon the wearing resistance. It is commonly recognized that wood fiber gives the more resilient flooring while asbestos fiber imparts the greater hardness and wearing resistance. The Dow Chemical Company has found, as averages of several tests of each kind of fiber in the standard flooring mix, the following interesting effect of fiber variation:

	Relative Immunity with Hard Maple Flooring as 100
Asbestos, long fiber	61
Asbestos, medium fiber	55
Asbestos, short fiber	47
White pine sawdust	50
White pine wood flour	42
Hard maple sawdust	40
Hard maple wood flour	31
Oak sawdust	45
Oak wood flour	41
California redwood sawdust	43
California redwood wood flour	38
Granulated cork	56
Cork flour	50
Hard yellow pine sawdust	43

The Dow Company considers the relatively high value of the white pine fibers as compared with the wearing resistance of white pine boards to be due to the fibers being insecurely bound in the board form. The wood flour fibers are 1/3 to 1/10 the size of the sawdust fibers, present a very much larger surface to be covered by a given amount of binder, and are thus less firmly held.

Upon investigating the effect of aggregate variation upon the wearing qualities the Dow Company ascertained the following:

Fine Aggregate	Relative Immunity with Hard Maple at 100	Tensile Strength
3 Powdered silica : 1 talc : 1 pigment	43	625
3 Powdered marble : 1 talc : 1 pigment	36	592
3 Powdered limestone : 1 talc : 1 pigment	35	606
3 Powdered Kieselguhr : 1 talc : 1 pigment	27	452
3 Powdered silica : 1 China clay : 1 pigment	65	703

This illustrates the unreliability of the tensile strength as a gage of the wearing resistance. That chemical composition is not the determining factor is also shown because Kieselguhr, or diatomaceous earth, is identical chemically with silica, both being silicon dioxide. The former, however, is much the softer. China clay shows up very well, but may have disadvantages in other directions which offset this good showing.

Solution strength is a big factor in developing a wear resistant composition deck covering. There is a very great increase in resistance to abrasion with an increase in the chloride strength from 16 degrees to 22 degrees, but little or no gain in this direction from the use of solutions above 24 degrees Baumé. A deck covering made with solution of low strength will wear three times as rapidly as one made with 22-degree solution. The greater loss in strength when wet, before referred to as a result of using weak solutions, results also in excessive wear.

Upon investigating the effect of stiffness of the mix upon the wearing qualities the Dow Company ascertained the following:

Consistency	Relative Immunity with Hard Maple as 100
No. 16 supporting 250 grams on 1 inch diameter surface	47
No. 20, supporting 250 grams on 1¼ inch diameter surface	46
No. 24, supporting 250 grams on 1½ inch diameter surface	43
No. 32, supporting 250 grams on 2 inch diameter surface	42
No. 48, supporting 250 grams on 3 inch diameter surface	37

It is evident that the tendency of inefficient workmen to mix the material too thin should be carefully guarded against.

Upon investigating the claim of the deck covering manufacturers that by a proper trowelling procedure a superior wearing product could be obtained the Dow Company ascertained the following, which amply justifies the claim:

Surface Treatment	Relative Immunity with Hard Maple as 100
1. Strike-off and immediate smoothing without any subsequent surface finishing	30
2. Strike-off, smoothing, and a moderately heavy trowelling at or about initial set	45
3. Same as (2) but with an additional heavy trowelling at about the final set	46

It appears from these figures that about 50 percent improvement in the resistance to wear is developed by the use of proper trowelling as against no surface finishing after the first smoothing; also that the second trowelling is of little or no value. Materials which set so fast that they cannot be properly trowelled and have to be finished off by rubbing with wire wool probably come in the class of the test (1) product.

The use of a properly designed machine mixer will result in increased wearing qualities as against the best hand mixing. Such use should also result in reduced labor costs.

For heavy duty service the Dow Company recommends a special mix containing silica sand when trowelled to a smooth top surface the hard silica sand grains present a very high wearing resistance and they are so firmly bound by the oxychloride cement that they are not, like the sand in most Portland cement floors, dislodged by the abrasive action of traffic. Such a mix shows an average wearing resistance four times that of hard maple and from eight to nine times that of the average composition deck covering of the resilient type. Its cost should be considerably less than the latter and be only a little above that of the best Portland cement flooring. It is questionable if this would be found to have sufficient toughness for shipboard use except in small areas; but there is a good field for a wear resistant material for spaces that are at times used for accommodations and at other times for cargo, and this may be a suggestion to that end.

(*To be continued.*)

American Shipping Service to the Philippines Adequate

THE Shipping Board has adopted a resolution certifying to the President that the American shipping service to and from the Philippines and other island possessions, with the exception of the Virgin Islands, is adequate, so that the President may issue a proclamation extending the coastwise laws to that service. As to the Virgin Islands, the board certified that the service would be adequate on 90 days' notice.

Ship Control on Modern Battleships

Communication and Signal Systems Handled by the Bridge Officer When He Takes the Deck at Sea

By Lt. Comdr. Alex. M. Charlton, U. S. N.

THE activities of a modern man-of-war may be separated under two general heads, fire control and ship control. Fire control includes the entire system of directing the offensive weapons of a vessel including material, personnel, methods and organization. Ship control comprises the entire system of maneuvering the vessel, the upkeep of the hull structure and the maintenance of water-tight integrity including the material, personnel and organization to obtain these objects.

The problem of handling vessels as large as our modern battleships in cruising formation requires the most accurate and rapid means of controlling the engines and steering gear possible. When it is considered that vessels cruise at a distance of five or six hundred yards from foremast to foremast the amount of open water between the stern of one vessel and the bow of the vessel astern of her seems almost negligible. To maintain accurate distance necessitates a fineness of control that would make the average merchant skipper very nervous.

Closed Type Pilot House

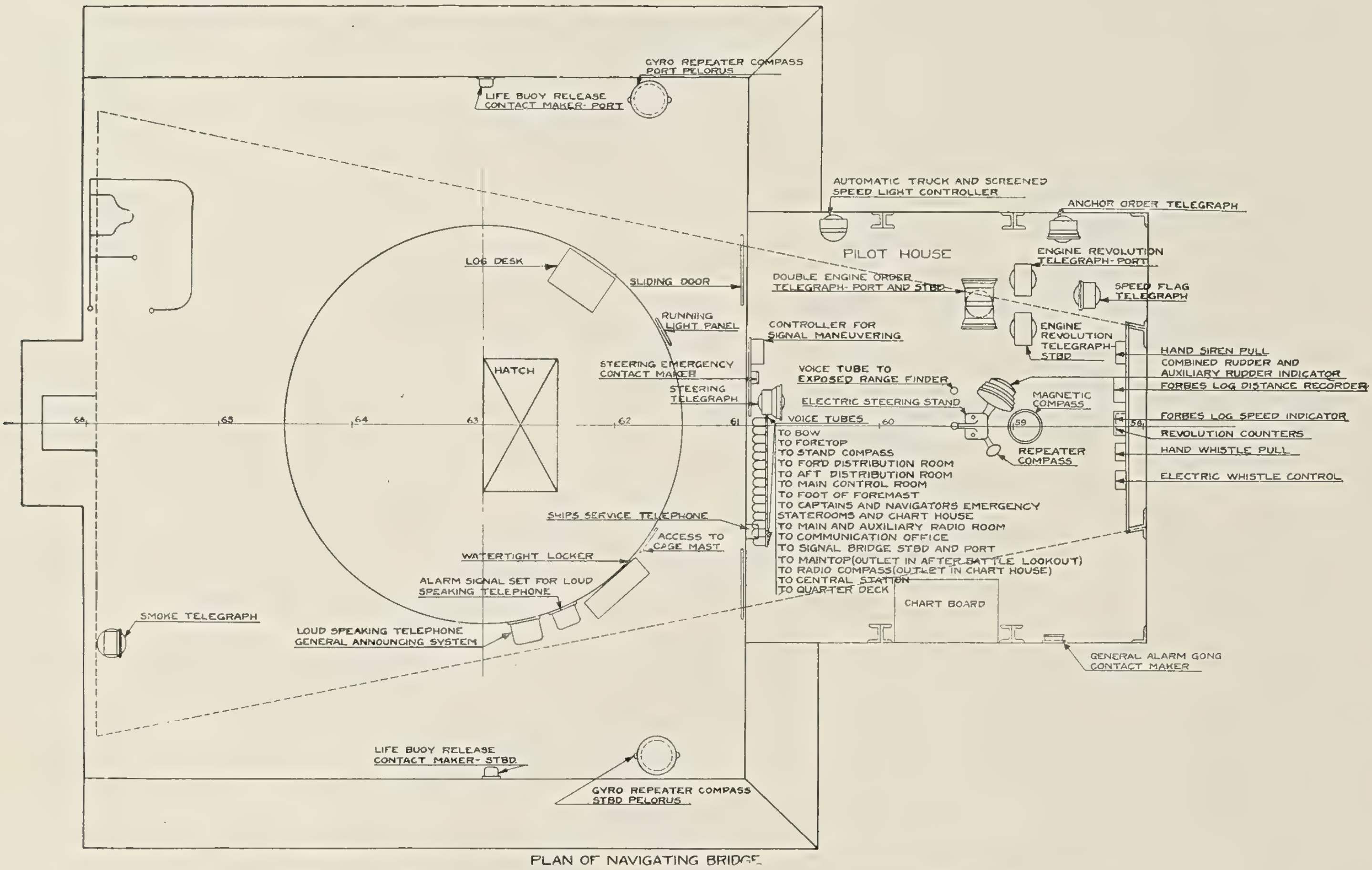
The experience of the Navy with North Atlantic weather conditions in winter led to the adoption of the pilot house type of bridge which can be completely closed in inclement weather. This in itself is a considerable advance over the old type of open bridge which caused the personnel on the bridge an untold amount of suffering in winter weather.

Steering System

Our vessels today are steered electrically, the steersman using a controller quite similar to a street-car controller. A man no longer stands a trick at the wheel, for there is no wheel. This controller operates a motor in the steering compartment which controls the movements of a hydraulic (oil) motor. Enough power is furnished to put the rudder from hard-over right to hard-over left rudder in twenty seconds. The position of the rudder at any instant is shown by the rudder indicators mounted on one side of the steering stand. One of these indicators is of an ingenious electric motor type in which a pointer is moved to the rudder angle by means of contacts made at the rudder head. The other indicator is of the lamp type in which a lamp is lighted behind the figures showing the rudder angle. The two systems are enclosed in the same case and work simultaneously, one as an auxiliary for the other.

In case the steering gear in the pilot house is broken down, a steering telegraph enables the proper directions to be sent down to the steering room at the stern of the vessel. This is a motor type telegraph.

Gyroscopic compasses determine the course of the vessel.



Plan of Navigating Bridge Showing Location of Communication and Signal Appliances

The master compasses are down below armor with connections to the repeater compass mounted on the steering stand. There is also a steering magnetic compass mounted in a binnacle just forward of the steering stand.

The standard magnetic compass is mounted on a platform high up in the foremast where it will be as free from the magnetic influence of the steel of the vessel as possible.

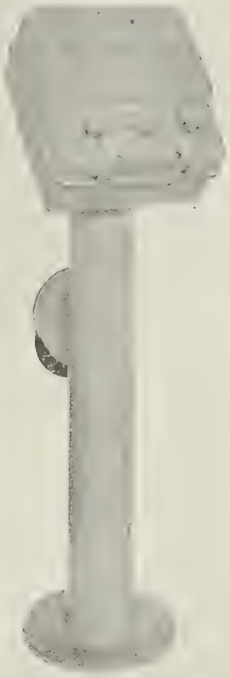
Engine Telegraphs

Engine order telegraphs are mounted on pedestals on the port side of the pilot house and arranged so that the transmitting handles point forward when the engines are going ahead and aft when the engines are going astern. These telegraphs are of the electric synchronous motor type and convey to the main engine control how the engines are to be moved.

Close to the engine order telegraphs are mounted the engine revolution telegraphs. These telegraphs transmit the revolutions desired at any time. They are of the motor type and will transmit revolutions by units from 0 to 299. By these telegraphs the engine room is enabled to tell the exact revolutions desired and so control the speed of the vessel to small fractions of a knot.

Rudder Indicator Motor Type

Electric Engine Order Telegraph Transmitter


Course Telegraph Transmitter Indicator


Automatic Truck and Screened Speed Light Telegraph Transmitter

When a vessel finds it necessary to change its speed in formation this information must be transmitted to the vessel astern so that she may be handled to avoid the possibility of collision. Small flags which indicate a vessel's speed in knots are displayed from the signal bridge below the pilot house level. The pilot house informs the speed flag station what the speed in knots is at any time by means of the speed flag telegraph, another motor type instrument. On the forward bulkhead of the pilot house are arranged a speed indicator and a distance recorder operated electrically from a small revolving shaft, which protrudes through the bottom at the pivoting point of the vessel. As this instrument is not connected with the propellers it gives the vessel's speed and distance run irrespective of the slip of the propellers, condition of bottom or the state of wind and sea. The indicator gives the speed in knots and the distance recorder gives the distance traveled in miles and tenths of a mile.

Revolution Counter

Alongside of the speed indicator are revolution counters actuated electrically from the propeller shafts. These counters do not give the instantaneous speed of the engines, but by cutting in a pointer and letting it run for thirty seconds or a minute the propeller speed may be obtained.

Distance Recorder

Speed Indicator

Whistle

Controls for the hand siren and the hand and electric whistles are also located on the forward bulkhead of the pilot house.

Speed Signals

For advising other vessels of the fleet what one's engines are doing a system of speed cones is employed by day, the various positions either with the apex of the cone up or down telling what speed the engines are making and their direction. At night a light is displayed at the main truck, white for ahead and red for astern. Pulsations of this light tell the speed of the engines. An automatic truck light controller is installed in the pilot house, which, upon placing the pointer at the proper indication, will automatically show the desired signal on the truck light.

Voice Tubes

Voice tubes are led from the pilot house to the standard magnetic compass in the mast, to the bow for handling the anchor gear, to the electric distribution rooms, to the engine control room, to the quarter deck, to the captain's and the navigator's emergency staterooms and the chart house, to the foot of the foremast, to the radio rooms, to the signal bridge, to the range finder on top of the pilot house, to the radio compass, and to the communication office. These voice tubes are fitted with call bells and supplement the ship's service telephone system and the maneuvering telephones with which communication may be had to nearly all the stations above mentioned.

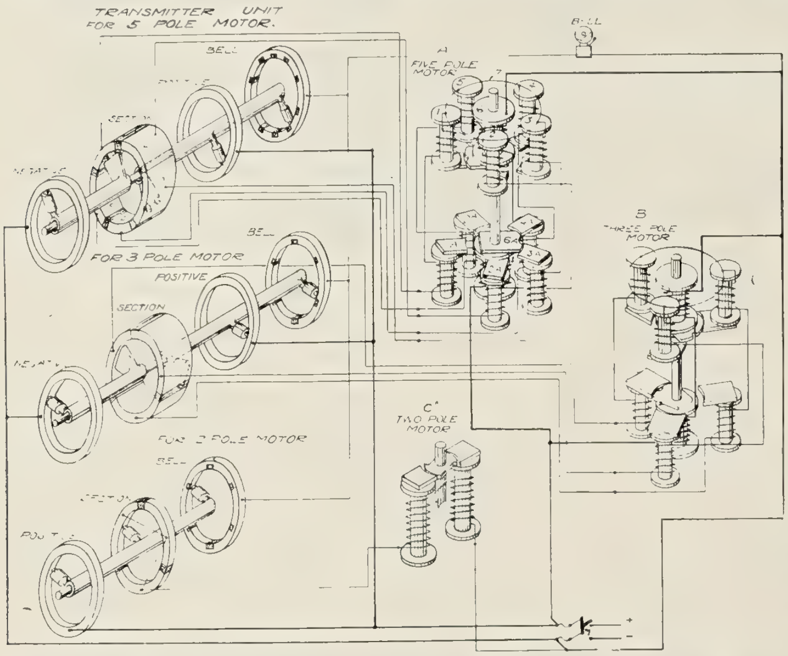
Pelorus

On the bridge outside of the pilot house are two gyro repeater compasses installed in pelorus stands, one on either side. These compasses are fitted with azimuth circles and

alidades for taking bearings. Each stand also carries a bracket in which may be mounted a small range finder for taking distances in formation and other small ranges. It is quite essential that the distance to the ship ahead be known at all times in order that the engines may be kept at the proper speed to maintain the standard distance. A stadimeter, the invention of Rear Admiral Bradley A. Fiske, U. S. N., is also furnished vessels for measuring distances. This instrument measures the angle subtended by the masthead height above the waterline. Knowing this height, the stadimeter is calibrated to read in yards. An adjustment is fitted for setting various masthead heights.

Life-Buoy Releasing Gear

On either side of the bridge are two life-buoy release keys which enable the Franklin life-buoys on the quarters to be let go from the bridge. These electric keys operate the solenoids of the release mechanism at the buoys.



Elementary Wiring Diagram for Electric Telegraphs, Rotary Type

Lights

A running light panel which controls all the running, anchor and peak lights is mounted on the cage mast.

The running lights comprise the side, masthead and towing lights, range light, stern light, steering light, wake light and screened speed light. The steering light is a minute light mounted on the jack staff for use in making turns in formation at night. The wake light shines down on the wake immediately astern of a vessel and gives information to the vessel astern when changing course.

Anchor lights comprise the forward and after anchor lights, the boom lights and the gangway lights.

The peak lights comprise the absentee lights, man-of-war lights, breakdown and man-overboard lights, and the flag lights. Absentee lights are white lights arranged one over the other abaft the mainmast and vary in number from eight for the President of the United States to one for the captain of a vessel. They indicate that the official or officer is ashore but will return within twenty-four hours. Man-of-war lights are two vertical white lights shown when a man-of-war is approaching an anchorage and displayed by anchored men-of-war when seen on an incoming vessel. Breakdown lights are two vertical red lights displayed by a vessel in formation when she is out of control. When the upper of these two lights is pulsated it indicates man overboard. Flag lights are two horizontal white lights displayed abaft the mainmast and indicate the presence of a flagship.

Telephone System

On the cage mast is a transmitter for the general announcing telephone system. This telephone allows orders, bugle calls, etc., to be transmitted throughout the vessel and announced in the various compartments. A buzzer of a peculiar tone is also fitted in this system as a signal for closing watertight doors.

At the rear of the bridge is the smoke telegraph by which the firerooms are notified to make smoke for screening purposes or to stop making smoke.

Anchor Telegraph

The great distance from the bridge to the bow on our new vessels has caused the installation of an anchor telegraph. This enables the bridge to signal the boatswain at the bow when to let go and how much chain to ride at and also to ask questions and receive answers concerning the ground tackle.

Docking Telegraph

On top of the pilot house are two docking telegraphs which signal electrically to the deck aft how to handle lines in coming alongside a dock.

A large range finder is also fitted on top of the pilot house for taking long ranges. A voice tube leads to the pilot house.

Signals

On the signal bridge are the racks for signal flags with halyards leading to the foreyard arms. Blinker signal keys are also installed here for operating the blinker lights at the ends of the yard-arms. Signals are sent using the Morse code, the keys being arranged like telegraph keys. The circuits are arranged so that the same signal may go out from all four blinker lights or four different messages may be sent simultaneously.

Searchlights

Two 24-inch high-powered signal searchlights are placed on the signal bridge for distant signalling. They are fitted with signal shutters so that signals may be transmitted by the Morse code. Two 12-inch portable searchlights are also provided for short range signalling.

Synchronous Type of Motor Employed

So many instruments of the synchronous motor type are employed that it may be interesting to describe the action of this type of motor. The elementary wiring diagram shows typical layouts with a transmitter and an indicator at each end for five, three and two pole motors. The indicator consists of magnets arranged equidistantly about a polarized armature which is free to rotate under the action of the magnets as the latter are energized from the transmitter. The latter is arranged so that as the handle is moved from one indication to another the circuits to various magnets in the indicator are completed and the indicator armature is pulled around to correspond to the transmitter indication. When the transmitter handle is moved a bell is rung at the indicating station. This type of motor is also made to indicate twenty positions with five poles by reversing the polarity of the fields and varying the number of poles energized at a time. Very little trouble is experienced with this type of motor when properly made, as it is self-synchronous and so cannot get out of step, takes little power and is very reliable. Most of the instruments of this type used in the Navy are manufactured by Charles Cory and Son under their various

(*Continued on page* 202.)

Application of Lubricants*

Where and How to Apply the Lubricant on Marine Machinery

Of equal importance to the selection of oils is the reliability of their method of application. There is a close relationship between the conditions under which an oil must serve its purpose, and the manner in which the oil is applied to the parts to be served. The various methods or systems by which oils are applied to the internal parts, generally termed cylinder lubrication, are as follows:

Hand Oiling.—Oil is applied by hand at intervals by means of an oil can, a hand oil pump or an oil swab or grease is applied through specially designed cups or by hand.

Drop Feed Oiling.—Oil contained in individual drop oilers is supplied at a regulated gravity action. The air compressor oil cup automatically supplies oil by air compression pressure.

Splash Oiling.—Oil contained in an enclosed chamber is splashed to parts requiring lubrication by the dip of a moving part of the machine.

Hydrostatic Lubricator.—Oil contained in a lubricator is discharged through an oil feed pipe by water displacement. The water is obtained from steam condensation.

Mechanical Force Feed Lubricator.—Oil contained in a lubricator is forced to the moving parts by one or two plunger pumps driven off some moving part of the engine or machine.

Knowledge of your lubrication problem will show the need of the proper method of application to suit the requirements of your special type of equipment.

Cylinder Lubrication

For the internal lubrication of:

(*a*) Steam engines and pumps;
(*b*) Diesel engines;
(*c*) Surface ignition oil engines;
(*d*) Air compressors;
(*e*) Refrigerating machines.

Steam Engines and Pumps

Cylinder lubricants are applied by the following systems:

(1) Oil cups (formerly known as "tallow cups");
(2) Hand oiling, i. e., swabbing the piston and valve rods;
(3) Hand pumps;
(4) Hydrostatic lubricators;
(5) Mechanical force feed lubricators.

(1) Oil cups, usually made of brass, some with two plug cocks, others with a screw top cover with one valve at the base, are attached on the top of cylinder or valve chest covers. The cup is filled with cylinder oil and then closed; and by opening the cock or valve at the base of the cup, the oil is permitted to flow into the cylinder or steam chest, as the case may be. This method is unsatisfactory, for it is spasmodic and wasteful, in that it requires too much attention.

(2) Hand oiling, swabbing the rods with cylinder oil, serves a lubrication purpose as far as the rods and rod packings are concerned, but this method of application is not satisfactory for cylinder and valve lubrication. Here again, the lubrication is spasmodic and uncertain, with the possibility of comparatively large doses of oil going out with the exhaust steam, which is the *main thing* to be avoided in marine practice.

(3) Hand oil pumps are sometimes installed, for use when starting an engine, and also when the engine is operating and there is a tendency for any of the internal parts to squeak or groan, as sometimes happens. But the hand oil pump is dangerous in the hands of a novice, because of the temptation to pump in more oil than is actually required, with the result that the excess oil goes out in the exhaust steam to the condenser. When it is found necessary to use the hand pump, judgment and care must accompany its use.

(4) The hydrostatic lubricator is one commonly used for the internal lubrication of marine steam engines. The lubricator is connected to the main steam pipe by suitable piping and valves. The principle of operation is as follows:

The body of the lubricator is filled with oil. Steam enters the condenser at the top of the lubricator, and is condensed. The interior construction is such that the condensed steam falls to the bottom through a small internal pipe. There is a pressure in the lubricator due to the pressure of steam in the main steam pipe, and an additional pressure due to the head of water in the condenser and piping above the body of the lubricator. The counter pressure at the outlet connection of the lubricator, into the main steam pipe, is that due to the pressure of steam in the main steam pipe. It is the unbalanced pressure due to the hydrostatic head, together with the fact that oil is lighter than, and floats upon, the water of condensation collected in the oil container, which causes the oil to rise and overflow into a small discharge pipe connected to the feed control valve at the base of the sight feed glass.

By the adjustment of the control valve, the oil is fed drop by drop at a certain rate, proportional to requirements for any given case. As the oil is used the water of condensation accumulates, until the body of the lubricator is emptied of oil, and becomes filled with water. The water is drained out and the lubricator refilled with oil, and the same cycle of operations is repeated.

The hydrostatic lubricator is not automatic in action, because it must be started and stopped by hand. Neither is it absolutely regular and uniform in its delivery of oil, as changes in temperature of the surrounding air, leakage or a slight obstruction in the small delivery tube passage will change the adjusted rate of feed, and in some cases the feed will stop. The hydrostatic lubricator requires close watching for best results.

(5) The mechanical force feed lubricator is essentially a small plunger force pump, contained in an oil reservoir, and driven by a lever and ratchet motion, actuated by some moving part of the engine. It is automatic, absolutely regular and sure in the delivery of oil, and its stroke may be adjusted to deliver within its range any desired quantity of oil in any period of time. Temperature changes have no effect whatever with this type of lubricator, and when once adjusted it requires no further attention other than to replenish the oil.

For best results, an atomizer is used with the force feed lubricator. The lubricator may be attached to any convenient part of the engine, and a pipe connection made to the main steam pipe, at a point a few feet back from the engine stop valve with a non-return check valve located at each end of the oil pipe. This point of connection is chosen in order to give the steam rushing through the pipe an opportunity to break up the drops of oil delivered through the atomizer. Thus the steam carries the oil in spray form to all internal moving parts of the engine. With a correct adjustment of the pump plunger, not any more oil than is actually required for lubrication will be delivered.

With this type of lubricator, a perfect control of the feed

*From *The Compass*, published by the Vacuum Oil Company, New York.

is attainable at *all times,* and delivery of oil takes place only while the engine is operating.

The steam cylinders of auxiliaries and pumps are supplied with lubrication in the same manner as that described for the main units. The usual method in marine practice being by swabbing the rod, although the hydrostatic lubricator is sometimes employed.

Diesel Engine

Cylinder lubricants for Diesel engines are applied by the force feed method, in which the mechanically operated force feed lubrication, already described, is employed. The lever movement may be actuated by an eccentric on the cam shaft, or receive motion through connection by a driving rod attached to some moving part of the engine.

The cylinders are lubricated by providing multiple force feed pumps with feeds to supply all the cylinders, one plunger for each cylinder and one plunger for each air compressor cylinder. In some engines, two, three or four plungers for each cylinder are provided, separate oil leads being introduced at different points around the cylinder. In some instances the supply from one plunger pump is applied to an oil pipe encircling the cylinder having 2, 3, or 4 leads. With this arrangement it is possible that the oil supply may be unequally distributed, and lubrication will be deficient; therefore, one lead from each pump to each cylinder may be considered the only reliable practice. Check valves are placed in the outlet end of each oil lead in order to maintain a full oil pipe. The leads should be so placed and connected that oil will be fed between the first and second piston rings when the piston is at the bottom of its stroke.

Surface Ignition Oil Engines

Oil is supplied under pressure from a mechanically operated force feed lubricator in which there are a number of small independent plunger pumps, each having a pipe or tube to conduct the oil to the desired point of introduction in the several cylinders. It is desirable to have these leads supply one point only, i. e., not branched to two or more points, because it is uncertain that the division of the supply of oil in such cases is equal.

Oil should be supplied to the piston of large engines at several points in its circumference and each of the leads should be served by an independent pump plunger in the lubricator. Smaller engines do not need as many points of application. A check valve is placed in each oil lead, as before referred to in Diesel engines. For the best effect, the stroke of the pumps should be timed to deliver the oil between the first and second piston rings at the instant the pistons are at their extreme outward travel (the bottom end of stroke).

Air Compressors

Oil is usually applied to the air cylinders by means of an air compressor sight feed drop oiler attached to the cylinder in a vertical position. It consists essentially of an oil container, a feed regulating valve and a ball check. In operation, the main valve is open wide, admitting air pressure to the container, and the regulating valve is adjusted to the desired rate of oil feed. The oil thus admitted to the cylinder is distributed over its walls and the frictional surfaces of the valves.

The definite method for supplying cylinder lubrication is by means of the mechanically operated force feed lubricator. The number of feeds required depends upon the size of the compressor. With such a lubricator the oil feed, once adjusted, remains constant and permits regulation for a necessary minimum rate of feed, avoiding the possibility of over-lubricating, which is one of the principal causes for carbonization on the voluntary discharge valves.

Feeding Oil Direct.—As a rule, it is best to feed the oil sparingly, uniformly and directly to the frictional surfaces. In horizontal compressor cylinders, the lubricating oil is usually introduced through one lead at the top and at the center of the cylinder. The oil is spread internally by the moving piston and forms the required complete sealing and lubricating film.

Vertical compressors with single acting trunk pistons may be lubricated by means of the splash oiling system, whereby a moving part of the machine dips into the oil in the crank case, producing an oil spray that reaches all parts. It is of greatest importance that a constant oil level be maintained in the crank case, for if the oil level is too low the oil spray will be insufficient and some of the parts will be "starved." If the level is too high, there will be too much splash and an excessive supply of oil will work past the piston rings and will lodge on the voluntary discharge valves. This will result in the carbonization of the oil under the extreme heat of compression, causing the valves to stick.

Refrigerating Machines

Cylinder lubrication of various types and kinds of refrigerating machines is accomplished by feeding oil to the center of the rod stuffing box. The stuffing box is much deeper than is required for steam engines and contains two sets of packing rings, separated in the center of the depth of the box by what is called the "lantern." The lantern serves a double purpose, namely, it forms a small reservoir for gas that leaks out from the cylinder and also serves as a container for the lubricant. There are usually two pipes connected into the lantern, one for introducing the oil, the other for withdrawing the gas—the latter pipe is connected to the suction side of the machine. In some installations, the oil is fed to the stuffing box by an ordinary sight feed oil cup, or by a small hand pump used intermittently at the discretion of the operator.

For carbon dioxide machines, when high compressor pressures are encountered (1,000 pounds per square inch), the mechanical force feed lubricator is employed. The movement of the rod back and forth, or up and down, as the case may be, carries the oil with it, thus lubricating effectively the rod packing and some of the lubricant is carried into the cylinder of the compressor, lubricating the walls and piston rings at the same time.

It is considered that sufficient cylinder lubrication may be obtained from that which is drawn into the cylinder by the movement of the piston rod, as most of the refrigerants used are somewhat of a lubricating nature, and it is desirable to have as little oil in the system as possible.

Ship Control on Modern Battleships

(*Continued from page* 200.)

patents, although other manufacturers have lately appeared in the field with similar instruments.

The telegraphs are mounted as pedestal or bulkhead instruments. Some are similar in appearance to telegraphs of the mechanical type, and others are made with the transmitter actuated in the face of the instrument.

Conclusion

To keep all of these instruments, lights and call bells in efficient operating condition requires the services of a good many men, but the safety of the vessel is so dependent upon their operating correctly when needed that no effort is spared on their upkeep.

The bridge equipment of a man-of-war may seem too elaborate to an officer in the merchant service, but it is hoped that the foregoing has shown the necessity for all the equipment used.

Relationship of Rail and Water Carriers*

Wide Piers and the Best of Mechanical Devices Needed for Closest Possible Liaison Between Land and Water Carriers

By William J. Wilgus

IN times when an impoverished world is practicing rigid economy as never before it is to be expected that trade between nations will flow along paths of least resistance and hence through those gateways which, other things being equal, exact the least tribute in tolls and time from the rail and water carriers which meet there for purposes of interchange.

Pier a Joint Terminal

The usual pier or quay after all is a joint terminal not only for the ship but likewise for the railroad and for the motor truck. Unfortunately too often this common ground is under the exclusive jurisdiction of one of these agencies, with dire results to the others. For instance, a steamship line in sole possession of a pier will seldom, if ever, provide proper space upon it for tracks on which the railroads may place their cars for delivering and receiving freight direct, when it may dictate to the railroads, without expense to itself, that the interchange shall be effected through the medium of trucking or of floating equipment with its added cost of breaking bulk and of tortuous waterfront and marine operations. This is the situation that obtains today in our greatest port, New York, originally brought about by natural conditions that ante-dated the railroad era, and later perpetuated through the provision in the seaboard rate that requires the railroad to interchange freight at shipside rather than at the end of the rail-haul.

> **The unification of the management under joint control, of rail and water terminals in the waterfront zone of each port is essential to a full solution of the port problem. With this should go a coordinating belt line under the jurisdiction of the port management; an "open door" for the vast fleet of independent craft that is unpossessed of exclusive facilities —leased or owned; and working arrangements with the trunk lines whereby freight consigned to the port shall be suitably grouped at distant clearing yards for movement direct to the particular location for which it is destined, without the need for intermediate reclassification or breaking bulk. There is much room for improvement through a further restriction of free storage which is now a wasteful burden on the rail carrier. Ample warehouses and open storage areas adjoining the piers and quays, with moderate charges, would go far to decrease this evil.**

The wastefulness of this process can be best illustrated by comparing it with the confusion, delays and excessive costs that would reign in a joint railroad terminal where differing gages of the main lines and yard tracks would make necessary the breaking of bulk or transfer of car bodies in transit, within sight of final destination, a condition too absurd for serious consideration.

Wide Piers Necessary

The remedy for this manifestly unhappy situation lies in the converting of port authorities and carriers, both rail and water, to the wisdom, or rather strict necessity, of abandoning the stingy pier policy and of building generously proportioned wide piers and quays on which there shall be ample space for transit and storage sheds, motor truck driveways and track layouts designed for continuous cargo handling uninterrupted by switching operations. All of the great ports of the Old World, and even the principal ones of South America and of our neighbor on the north, Canada, have taken this foresighted course, and in this country the more progressive of our ports have rather timorously done likewise. But there are many of our ports, notably New York, where the narrow pier policy still rules. In planning for the future, then, let us remedy our past faults and substitute wide piers for the inefficient and wasteful narrow, trackless ones which we have inherited from the days of the sailing ship and canal boat.

Another direction in which there is a burning need for improvement is the more extended employment of mechanical equipment for reducing the expense of cargo handling and for expediting the release of ships and cars.

For example, in the World War the American Army in France operated in from twenty to thirty ports at which in the last month of the war, November, 1918, were discharged, by a variety of methods, nearly a million tons of supplies at an average rate of 449 tons per ship per day, or approximately one and one-tenth tons per lineal foot of ship berth per day. At one of these ports, American Bassens, there had been completed at that time a partial installation of electric gantry cranes which despite many handicaps, such as untrained operators, poor lighting facilities, shortage of cars and stevedores and insufficient "tuning up," made an average record of 717 tons per ship per day, equal to one and eight-tenths tons per lineal foot of ship berth. This was in marked contrast to the 371 tons per ship, or nine-tenths of a ton per lineal foot of ship berth, discharged daily at the neighboring berths where the non-completion of the gantries made necessary the handling of similar cargoes by ship tackle not only with less speed but also with greater damage to the supplies, and with much more rehandling between ship, car and shed by reason of the shorter radius of action of the ship tackle.

A Job for the Shipping Board

Relief in all these particulars would appear to be hopeless unless some competent central governmental agency, clothed with power, shall vigorously take up the problem in all its phases, commercial and military, with the determination promptly to find and enforce the application of remedies. It is idle to expect that the ship interests and the many railroads will make any substantial united progress in that direction.

Under Section 500 of the Transportation Act of 1920 the

*Paper presented before the American Society of Civil Engineers

duty is placed upon the Secretary of War to investigate this very problem in harmony with the declared policy of Congress "to promote, encourage and develop water transportation service and facilities in connection with the commerce of the United States, and to foster and preserve in full vigor both rail and water transportation." Along with this it is the duty of the Interstate Commerce Commission in the interest of the country at large, now called upon to underwrite the return on railroad investments, to look into and correct matters that affect the operating expenses of the railroads which are burdened with much of the wasteful practices at our ports, from which waste the water carriers, often flying a foreign flag, are reaping benefit. Then it should not be forgotten that as a people we are vitally interested in the provision of efficient ocean port terminals for our gigantic merchant marine, as to which it is the duty of the Shipping Board to take action.

LETTERS TO THE EDITOR

Wear of the Teeth of Marine Turbine Reduction Gears

The writer has read with keen interest Mr. F. W. Dean's letter under the above title in the February number of Marine Engineering and Shipping Age and agrees with Mr. Dean that it is unfortunate that such refined workmanship is necessary on marine reduction gears.

However, in view of the fact that friction is always the cause of wear regardless of what the material, whether the hardest diamond ever found or the softest lead, we may as well take it for granted, right now, that there will *always* be wear in reduction gears whether made for marine use or for stationary service. As soon as wear is eliminated, according to the writer's viewpoint, we will have a transmission efficiency of 100 percent.

One way to get around the wear evil, to be sure, is to eliminate gears altogether and use the electrical reduction method, but, no matter what the extent of the development of the electrical method, it is quite likely that there will always be a demand for and a field for the geared method.

There are several reasons why the herringbone type of gear is so popular—reasons why, probably, no better gear reduction method will ever be developed. The slanted tooth is less noisy than the straight line tooth. When the De Laval geared turbine first came out the writer remembers that a great hullabaloo was made about the noises generated in addition to the power. It was claimed by some engineers at that time that the reduction gear would never be a success on account of the noise feature alone. The slanted tooth is also stronger than the straight line tooth—not so liable to break off. A tooth is only a cantilever beam. By relieving this beam of shock, as is done by slanting the beam, the breakage danger is lessened. Also, the end thrusts are taken care of, alinement collars and bearings becoming automatically eliminated.

This latter advantage is considered a disadvantage by Mr. Dean and it doubtless is a disadvantage in the matter of wear, but I cannot see that conditions would be bettered by making the teeth straight as far as wear is concerned. Let us assume that with straight tooth reduction gears ample room would be allowed for side-play. After the very first day of usage we would have some wear because there would be some friction. Then we would move the pinion over one-half inch to prevent the pinion from "wearing a groove for itself" in the large intermeshing gear. However, even after the first day we would no longer have a "perfect fit" nor as good a fit as was had on the first day because a part of the large gear would be used that was not worn on the previous day and that part would place greater pressure on the pinion tooth end than was encountered during the entire first day. Consequently the ends of the pinion would wear down first and regardless of sliding back and forth to "even up" the wear we would find the pinion "wearing a groove for itself."

In talking to a large user of reduction gear turbines not long ago that user remarked: "No matter how accurately the gears are machined they'll never get away from the fact that steel is elastic, that all kinds of metals are elastic, and that the elasticity is great enough to throw all of their wonderful *theory* into the scrap heap." He may have exaggerated the case a bit, but there is a "mountain" of truth in what he said nevertheless.

As for making the large gears out of cast iron and the pinions out of steel, that sounds plausible to the writer. I do not know why it is not done nor do I know if it has been tried on high power reduction drives.

New York. N. G. Near.

The Future in the Shipbuilding Industry

The Armament Conference and its results while canceling many valuable contracts are only part of the reaction expected in the munition and allied trades by every reasonably thoughtful engineer after the war came to an end. It is a natural and not an abnormal condition. Whatever may be said of the great and acknowledged evils of militarism like everything else they had certain compensations. The huge navies of the past have left behind them large industrial plants and produced coaling and repair facilities, charts and other aids to navigation in extended and remote quarters of the world, and their staffs have advanced mechanical construction to perfection by a lavish expenditure on experiments that private enterprise would have been entirely unable to afford.

So much we have as a tremendous legacy today on which to build prosperity in the future.

The world is not bankrupt but its books are tangled up. Its purchasing power as a whole is measured by raw materials for barter and by the needs and numbers of its citizens, which have not been very materially reduced.

The money represented by interest on war bonds goes into some people's pockets and, if the pages of history are an accurate guide to the future, will be spent sooner or later in such luxuries as trips to Europe, yachts, and in permanent investments. There is possibly danger of excessive spending, for unfortunately few can resist the corrupting influence of wealth as experience has shown in both ancient Rome and modern India.

We desire a mercantile marine. Canal dues are complicated by treaty stipulations and subsidies confronted with political difficulties. If tourists were compelled to return in our own ships to obtain entry, it might help things somewhat. Also where there is no probability of displacing American labor our otherwise idle shipping might operate between Asiatic ports with Asiatic crews as the only method of competing with foreign vessels employing Lascars.

Vallejo, Calif. C. E. Burnley.

A Correction

In the article describing the American motorships *Californian* and *Missourian,* published in our February issue, it was erroneously stated that the steering gear was furnished by the Hyde Windlass Company. The electro hydraulic steering gear installed on both the *Californian* and *Missourian* is the A-E-Co Steerer furnished by the American Engineering Company of Philadelphia. The windlasses on both these vessels were also furnished by the American Engineering Company.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Is Superheated Steam a Perfect Gas?

Q. (1149).—I am informed that steam heated to 1,000 pounds is nearly a perfect gas. Is there any sense to that statement?

A. (1149).—Such information as is available seems to indicate that at high degrees of superheat and pressure the characteristics of steam approach those of a perfect gas.

Probable Earnings of the Leviathan

Q. (1150).—Can you furnish information as to the probable earnings of the ex-German steamship *Leviathan* in case she were reconditioned and put into the Atlantic passenger service?

A. (1150).—Conditions in the Atlantic passenger trade are somewhat unsettled at the present time, owing to the world-wide business depression and to the readjustment which is taking place on both sides of the Atlantic. The following information, which is quoted from the Atlantic Coast Shipbuilders' Association Bulletin for January 27, 1922, is believed to give as satisfactory a statement for your purpose as is possible under the conditions:

"The probable gross earnings of the *Leviathan* would be $500,000 a voyage, against disbursements of $350,000 per voyage, according to an official of the Emergency Fleet Corporation, figuring out to a net earning of $150,000 per voyage. The figures are based on filling, on the average, of one-third of her total passenger accommodations throughout the year, on carrying a certain rate of mail and on certain other sundry earnings from baggage and so forth. The same official said she ought to earn $150,000 a voyage for fourteen voyages a year. He points out that there must be taken into consideration deductions from net revenue of $250,000 for dry docking and lay-up cost, interest at 5 percent and depreciation. Reconditioning cost of $6,697,303, $1,502,697 for trial trip, insurance and inspection would amount to $1,206,666 annually."

Thickness of Shell Plating in Shallow Draft Vessels

Q. (1151).—What do you regard as the considerations governing the thickness of shell plating in vessels built for use in shallow water?

A. (1151).—In vessels of this class draft and therefore, weight of structure are of the first importance. If the vessel is to be restricted in its use to the inland portions of rivers, the provision against local damage such as grounding and the necessary allowance for corrosion, would be important considerations, both of which are antagonistic to extreme lightness of plating. The character and distribution of cargo and the conditions of navigation, such as current, obstructions, etc., should also be studied. If, however, the vessel is to be used in the mouths of large rivers or along the coast where heavy swells may be encountered, it is necessary to consider the effect of waves upon the ship girder. In this case, in addition to the considerations mentioned above, the ratio of frame spacing to plate thickness is important. The value of this ratio in certain cases with which the writer is familiar may be obtained from the following table:

Ship No.	Length, Feet	Frame Spacing, Inches	Plating Thickness Midships	Ratio of Frame Spacing to Plate Thickness
1	144	18	.22	82
2	176	20	3/8	53
3	167	18	1/4	72
4	200	18	5/16	57
5	160	20	1/10	200

The last ship, No. 5, is a war vessel and represents an extreme which it would be unwise to approach in commercial practice.

Professor Hovgaard in his "Structural Design of Warships," under the heading "Longitudinal Strength," presents a discussion on the subject of bending which is of value in connection with the above.

Pitting of Shafting and Hull Plating

Q. (1146).—We are troubled with pitting of shafting and plates on hulls tied up at our piers, which we attribute to "electrolysis." Can you give us some information on this sort of trouble or recommend some literature pertaining to it?

A. (1146).—The information given is hardly sufficient to permit of more than a very general reply.

In practice that part of the propeller shaft within the stern tube is generally covered with brass liners and the tube is always full of sea water. Electrolytic action takes place between the brass and the iron in consequence of which the latter often becomes deeply corroded close to the end of the liners. On this account United States naval practice formerly required the fitting of zinc plates on the rudder, sternpost, shaft struts and shaft tubes, and zinc rings around composition sea chest openings. The zinc rings now have been superseded by medium steel rings and doubling plates, which serve to provide an excess amount of electro-positive material which can be readily removed when corroded. The use of zinc plates on the rudder, sternpost, etc., has been abandoned generally, since experiment has shown no injurious effect due to their omission.

It is to be assumed, of course, that such precautions as the above have already been taken. If this is the case, it may be that, for one reason or another, the water around your piers contains certain acids which greatly strengthen the electrolytic action. Chemical analysis of a sample might then prove of value.

Comment on the corrosion of metals under varying conditions may be found in the following:

"Corrosion and Preservation of Iron and Steel" by Cushman and Gardner.

"Practical Shipbuilding" by Campbell Holms, Edition 1918, Vol. I, Articles 566 and 569.

"Shipbuilding Cyclopedia," Edition 1920, Dictionary Section, under the term "Wrought Iron."

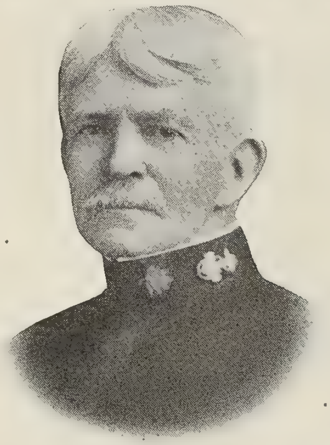
PERSONAL MENTION

Joseph W. Powell, president of the Emergency Fleet Corporation, has resigned his connection with the corporation to take effect this month.

Rear Admiral Robert S. Griffin, U. S. N. (retired), has recently become associated with Commander William L. Cathcart, U. S. N. R. in marine and naval engineering consulting work at 149 Broadway, New York. Until his retirement in September, 1921, Admiral Griffin had been for about eight years Engineer-in-chief of the Navy and Chief of its Bureau of Engineering (formerly Bureau of Steam Engineering). In addition, he had been for nearly five years previously, Assistant to the then Engineer-in-chief, so that his intimate association with, or personal direction of the technical and financial affairs of this most important Bureau have covered a continuous period of more than thirteen years, during which every combatant vessel now in our Navy was either designed or built. This period also covered the duration of the world war in which our Navy grew to a strength of 600,000 men and had nearly 2,000 vessels of all classes in commission, of which eventually we had in European waters a total of 338 ships, carrying 5,000 officers and 70,000 enlisted men. To the tireless energy of Admiral Griffin and his staff, at Washington and in our various Navy Yards, is due the fact that, throughout the whole war, no major vessel of the Navy was ever delayed by repairs to her machinery. An outline of the Bureau of Engineering's field prior to and during the war will give some conception of the magnitude of this work. That field covered all steam, all electrical and all internal combustion engines for the propulsion of naval ships; the bulk of the electrical apparatus for surface ships, submarines and aircraft; the machinery for aircraft; the generation and supply of gas for observation balloons and dirigibles; and finally extended radio telegraphic work in the design and supply, during the war, of the entire wireless equipment of all shore stations in the United States, in our island possessions and on every vessel, merchant or naval, flying the American flag. On September 1, 1921, all aircraft equipment—machinery, electrical apparatus and balloon gases—was transferred to the new Bureau of Aeronautics. Admiral Griffin was born at Fredericksburg, Va. He was educated in the private schools of that historic town and at the U. S. Naval Academy. After graduation at Annapolis in 1878, his early years in the Navy were spent in engineering duty afloat and ashore. His sea service ended in 1905, when he was acting as Fleet Engineer of the Atlantic Fleet, an assignment which had followed a similar one in the European squadron. From then onward, he served almost continuously in either the design or the construction of naval machinery, until he assumed office as Engineer-in-chief and chief of the Bureau of Engineering. The Admiral was awarded the Sampson Medal for his services in the Spanish-American war and also the U. S. Distinguished Service Medal for his work during the world war. The French Government made him a Commander of the Legion of Honor in recognition of his services to the Allied cause. He was granted the honorary degree of Doctor of Science by Columbia University and of Doctor of Engineering by the Stevens Institute. He is a member of the National Research Council and an Honorary Member of the American Society of Mechanical Engineers.

Rear-Admiral R. S. Griffin, U. S. N.

Commander William L. Cathcart, U. S. N. R., associated with Rear Admiral Robert S. Griffin in consulting work, was educated at the University of Pennsylvania and at the U. S. Naval Academy. After his graduation at Annapolis, he served for sixteen years in the former Engineer Corps of the Navy, afloat and on inspection duty ashore. He then resigned to enter private business. Later he became Adjunct Professor of Mechanical Engineering at Columbia University, then served for some years on the scientific staff of the Babcock and Wilcox Company and is now Professor of Engineering at the Webb Institute of Naval Architecture, New York City. During the Spanish-American war, Professor Cathcart volunteered, was appointed a Chief Engineer in the Navy and was ordered to special duty at the Navy Department in confidential service under Admiral Melville then Engineer-in-chief. At the outbreak of the world war, he again volunteered, was appointed Lieutenant Commander, U. S. N. R., and served at the Navy Department as confidential aide to Admiral Griffin. He remained on this duty for nine months after the war closed. In recognition of his service, he was promoted to the rank of Commander on recommendation of the Board on Selection.



Commander W. L. Cathcart, U. S. N. R.

Captain F. L. Iverson has been appointed to command the new passenger ship *Reliance* of the United American Lines. The *Reliance,* together with her sister ship the *Resolute* was recently purchased by the Harriman interests from the Royal Holland Lloyd Line. These boats will be used to maintain a fortnightly passenger service between New York and Hamburg with calls at French and English channel ports. At the present time Captain Iverson is in command of the United American Line passenger ship *Mount Clinton.* He will assume his new command about the first of March. Captain Iverson took command of his first ship in 1892. This was a foreign going sailing vessel operating out of New York. After seven years on various sailing craft he became associated with the American Line and served with their steamers for about seven years. For nearly ten years he commanded the pleasure yachts of several well known Americans. During the war Captain Iverson was in command of the transport *Liberator.*

Capt. F. L. Iverson

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

Over Twenty-Six Millions in Ship Work Contemplated and $12,788,820 Worth Of Contracts Placed in Seven Weeks

Developments of First Part of 1922 Indicate Remarkable "Come Back" of America's Marine Industry—Construction, Repair and Equipment Men Encouraged

BUSINESS conditions in the marine field during the first seven weeks of 1922 show a decided turn for the better if such things as the amount of prospective contracts receiving serious consideration and the amount of business placed can be accepted as a criterion. It is interesting to note that from January 1 to February 18 inclusive MARINE ENGINEERING AND SHIPPING AGE has reported over $12,788,820 in contracts placed and approximately $26,281,000 in ship construction and repair work contemplated.

Among the latest encouraging developments may be included the awarding of the *Leviathan* contract for $8,200,000, the report of two $3,000,000 ships under consideration for the Great Lakes, $4,500,000 asked for six seagoing dredges for the Government, the awarding of the contract for the construction of four steel ships in Montreal, awarding of 10,000-ton freighter at Port Arthur, Ont., two ships to be built for the Bay Line, Baltimore, Md., two ships considered for the Eastern and Clyde Line Steamship Companies jointly, ten steel oil barges for Galveston, one steel oil barge for the New York district, one vessel for Philadelphia to be used as a water boat, the prospective reconditioning of the army transport *Madawaska*, the passenger ship *Princess Matoika*, a large number of Shipping Board vessels and in addition various other repair work.

Ship charters continue fairly active, the movements of grain and sugar cargoes giving new impetus to the activity in ocean freights, and evidence of preparation for the heavy spring passenger traffic is abundant. The prevalent opinion among marine men is that "Things are looking up," and this belief is borne out by the facts.

Millions May Be Saved by New Stevedoring Rates Announced by the Shipping Board Commissioner

Further Reduction of Twenty Percent Expected to Follow Previous Cut of Fifteen Percent—Pacific Coast Situation to Be Taken Up Following South Atlantic and Gulf Ports

COMMISSIONER T. V. O'CONNOR, of the United States Shipping Board, announced on February 7 that a new schedule of stevedoring rates would go into effect at the port of Baltimore on February 10, which, it is expected will reduce stevedoring costs radically at that port. A new schedule for the port of New York was inaugurated on February 1, and a new schedule was in course of preparation for the port of Boston. This schedule will be followed by a new one at the port of Philadelphia.

Commissioner O'Connor states that after the entire stevedoring situation at northern ports has been revised, the Stevedoring Committee of the Board having this matter in hand will proceed to southern ports to revise the rates now operative there. It is expected that the Pacific Coast situation will be taken up after the South Atlanic and Gulf ports have been revised, which will complete a reduction in stevedoring costs at all ports in the United States. It is confidently predicted by Commissioner O'Connor, who is supervising stevedoring work for the Shipping Board, that several million dollars will be saved the Board by the new rate schedules already arrived at and those to be worked out in the next few months.

Some months ago stevedoring rates were reduced 15 percent owing to a reduction in the cost of labor of that amount. It is expected that the schedule of rates just put in force will work a further reduction of at least 20 percent and perhaps considerably more.

The schedule at New York has been worked out according to trades, the rates being fixed in each trade according to the peculiarities of cargo handled and the number of ports to which the lines run. A set of conditions was also worked out to control the operation of the new schedule, which conditions are uniform for the entire port of New York. Negotiations have been going on for some time.

Half Million Dollar Job on S.S. Columbia Awarded Sun Shipbuilding Company

The steamship *Columbia*, formerly the *Great Northern*, sister ship of the *Northern Pacific* which was destroyed by fire recently, has been purchased from the United States Government by the Admiral Line at a price said to be $1,250,000 and the contract for reconditioning the ship for service for the Admiral Line has been let to the Sun Shipbuilding Company, Ltd., at Chester, Pa., at a price reported as close to $500,000, according to latest advices received by MARINE ENGINEERING AND SHIPPING AGE.

It is announced that the *Columbia* has been ordered from Cuba to the Brooklyn Navy Yard where various navy equipment will be removed, the vessel then to proceed to the Sun shipyard at Chester, where a large force of workmen will begin the work of reconditioning the ship. It is understood that the work involves extensive hull and machinery repairs, the biggest item probably being the work incidental to the installation of first class accommodations for about 675 passengers.

Bids Asked for New Cable Ship to Cost About Half a Million

Plans and specifications have been completed by the firm of Cox and Stevens, naval architects, 25 Broadway, New York, for the construction of a new cable steamer, bids for which will open on or about March 1. Preliminary estimates place the cost of the ship at approximately a half a million dollars.

The vessel will be about 169 feet long, 30 feet beam, 22 feet 6 inches depth constructed of steel. She will be an oil burner driven by a triple expansion engine, 17 by 25 by 45 by 30-inch stroke. Steam will be supplied by two Scotch boilers, 12 feet in diameter, 11 feet long with a steam pressure of 185 pounds. In addition to other equipment, the vessel will have a steam-driven ice-making machine of 4 tons capacity.

Brazil Reported in Market for New Ships

Experts in the commercial life of Brazil arrived at Newport News, Va., on February 16, from Washington, D. C., on board the pilot boat *Virginia*. They were scheduled for inspection of the plant of the Newport News Shipbuilding & Dry Dock Company and it is understood their country is in the market for ships. They were given a luncheon by the shipyard at the Tidewater Club and were later banqueted by shipping and business interests.

Award of Half a Million In Shipping Board Reconditioning Contracts Is Under Way; Lone Star State Was the First of Series

Plans and Specifications Cover Chiefly the Installation of Third Class Passenger Accommodations in Preparation for Spring Rush

THE first of a series of repair contracts which will probably reach a total cost of close to half a million dollars, is expected to be awarded by the Shipping Board at 45 Broadway, New York. The contract for the reconditioning of the steamships *Lone Star State* and *Peninsula State,* the principal work to consist of extension of the third class passenger accommodations, has already been awarded to the Robins Dry Dock & Repair Company, Brooklyn, N. Y., at a price of $84,000.

It is expected that, following the *Lone Star State,* six other of the "State" ships will undergo similar reconditioning from time to time. The *Lone Star State* and *Peninsula State,* it is reported, will probably make about four trips for the United States Line, when they will be replaced permanently by the *Hawkeye State* and the *Buckeye State.* All of these vessels are "535s." The *Panhandle State, Centennial State* and the *Old North State,* which are of the "502" class, will probably also be similarly equipped.

The extension of the third class accommodations in these American passenger ships will be completed in time to meet an anticipated rush of business in ocean traffic which is expected to start early this spring.

$100,000 Job Coming on Steamship Princess Matoika

Further preparation for the spring rush of ocean passenger traffic will be made on the steamship *Princess Matoika* upon her return from her forthcoming voyage, when accommodations will be installed in the ship for approximately 1,200 third class passengers. Plans and specifications for this work are reported to be already under consideration and it is expected that the work of reconditioning the ship will reach a total close to $100,000.

The steamships *Hudson* and *Potomac* will also be added to the list of ships which are to undergo extension of third class accommodations.

SHIP OWNERS MEET

Steady Improvement in Shipping Predicted Following Federal Aid

At the annual meeting of the American Steamship Owners' Association, on February 6, at 11 Broadway, H. H. Raymond, president of the Clyde-Mallory Lines, was reelected president of the association, and Edward J. Barber, president of the Barber Steamship Lines, Inc., was reelected vice-president. The shipowners went on record unanimously in favor of the adoption of a Continuous Discharge Book of reference and recommendation for seamen, similar to a system long in effect in the British merchant service and now in effect on the Pacific coast of the United States.

Resolutions of sympathy on the death of Albert R. Lafonta, president of Harriss, Magill & Company, Inc., and of the firm of Trosdal, Plant & Lafonta, ship operators, were adopted. Winthrop L. Marvin, vice-president and general manager, and J. Parker Kirlin, Esq., general counsel, were reelected by the executive committee.

President Raymond, in closing his report of the activities of the association for the past year, referred to the year as one of world-wide depression in the shipping trade, and added that American shipowners are convinced that if the Federal Government keeps its pledge of giving the ocean shipping industry proper aid comparable with that long extended to other industries, there will from now on be a steady improvement in the status of the American merchant marine.

President Raymond further reported that the total gross tonnage of seagoing steamships owned by member companies of the association was 3,309,478, a gain of 343,400 over the preceding year.

QUICK TURN AROUND

Steamship George Washington Is on Notable Voyage

When the steamship *George Washington,* of the United States Lines, left the port of New York on February 14, she accomplished one of the quickest "turn-arounds," for a vessel of her size, in the history of the harbor.

Advices received by the United States Shipping Board Emergency Fleet Corporation, showed that the big liner, delayed by gales and fog on her voyage from Bremen, was unable to reach her pier until February 12. Immediately upon being made fast to the dock, the work of discharging her cargo and furnishing her with fuel and supplies began. The colossal task involved continuous labor both by day and night, and as a result of the superhuman effort that was made, she was enabled to sail in a little more than 48 hours, fully conditioned, with 652 passengers, on a voyage that will last to the middle of April.

The cruise of the *George Washington* gives promise of being a romantic one, for the women outnumber the men making the trip, by 200. Of the 652 passengers, 426 are females and 226 males, and of the former 155 are single girls, many of them being debutantes making their first oveaseas voyage.

During the cruise the *George Washington* will touch at Azores, Madeira, Cadiz, Gibraltar, Algiers, Palermo, Naples, Athens, Constantinople, Beirut, Naifa, Alexandria, Cerfu, Cattaro, Corsica, Villefranche and Cherbourg.

Captain Harold R. Cunningham, skipper of the *George Washington,* brought the liner from Quarantine to Hoboken and made fast, all in 70 minutes, which was considered remarkable work in view of the weather which prevailed.

New Passenger Services

The Algerian American Line, 44 Whitehall Street, New York, which was recently incorporated, announces a new steamship service to Italian, Spanish and North African ports, to be inaugurated with the sailing of the French steamer *Bay Verdun* early in March. The service will be started with three ships of 9,000 tons each, and three additional vessels of 10,000 tons each will be added later.

The American Line of the International Mercantile Marine Company, 9 Broadway, New York, has announced plans for the operation of a regular passenger steamship service from Philadelphia and Boston to Queenstown and Liverpool, beginning in March. The steamers *Pittsburgh* and *Haverford* will ply in this service.

Steamship Interests

A report from San Francisco states that a new steamship company, financed by American and Chinese capital, is negotiating with the War Department for the purchase of surplus transports, to be used in a service which they propose to establish between Pacific Coast and Chinese ports with feeder lines to the Straits Settlements.

Fred W. Eansor, head of the Southern Shipping Company, Jacksonville, Fla., has announced the inauguration by his company of a regular schooner line between Jacksonville and the West Indies. Two vessels are now in this service and more will be added as business warrants.

According to an announcement by the Shipping Board at Washington, D. C., the new passenger steamers *Nutmeg State* and *Palmetto State,* of 13,000 tons each, have been assigned to the Munson Steamship Line as managing agents for service to South America.

The United States Lines have announced the installation of a one-cabin service between New York, Queenstown, Cherbourg, Southampton and London to be inaugurated with the sailing of the *Panhandle State, Centennial State* and *Old North State,* these ships to be shortly augmented by two others. The conversion of these "State" vessels for the new service involves merely the addition of two berths above the present hotel beds, thus giving accommodations for four persons instead of two. The changes in the three boats will be started immediately and the new schedule will be in full operation in time for the spring rush.

According to an announcement from Boston, Mass., the United Fruit Company has made a reduction of about 20 percent on grain rates to Jamaica and the east coast of Colombia. Rates on rice have also been reduced.

The Robert Dollar Company has purchased four steel freighters of 10,200 deadweight tons each, at a price of $300,000 or less than $30 per deadweight ton. They are the *Cathay, Celestial, Oriental* and *Mandarin* which were built for the Shipping Board by the Kiangnan Dock & Engineering Company's yard at Hongkong, China, at a cost of about $200 a deadweight ton. They will be used by the Dollar Company in their coastwise trade.

Sixty More Ships May Be Put Into Service

Newport News, Va. (Special).—United States Shipping Board officials here, having been advised that headquarters in Washington expect to see the sugar business from Cuba to America take a big jump shortly are planning to get perhaps as many as 60 of the "lake" type of steel vessels down from Camp Eustis' idle fleet for repairs.

Two Palatial Ships Planned For Lake Service; Wilmington Firm Will Build Two for Seaboard-Bay Line

Four and a Half Millions May Be Spent for Sea Dredges—Newest Developments Give Powerful Impetus to Forward Movement of American Marine Industry

SIX MILLION DOLLARS for the construction of two new passenger ships for Great Lakes service, a request for an appropriation of $4,500,000 for the building of six seagoing dredges for the Government, and the awarding of a contract for two passenger and freight steamers for service between Baltimore, Md., and Old Point Comfort and Norfolk, Va., at a total cost of approximately $2,000,000—these are the "high spots" in the latest developments in American marine activities.

The two newest additions under consideration for the Great Lakes fleet, originally reported by Marine Engineering and Shipping Age on July 30, 1921, will be of the most palatial type, about 600 feet in length, for the Cleveland & Buffalo Transportation Company, Buffalo, N. Y. Complete details as to propulsion, machinery, or other equipment for these vessels are not yet available as it is understood that plans and specifications have not yet been completed. With regard to the two steamers for the Seaboard-Bay Line, which were forecasted in our weekly issue of January 28, the contract has been awarded to the Pusey & Jones Company, Wilmington, Del. It is believed that these vessels will cost close to a total of $2,000,000.

These vessels will be built of steel, 330 feet long, 58 feet beam, 18.6 feet deep and of 2,750 gross tons. The steel shell will have flared out guards, thus dispensing with the usual overhung deck supported by brackets or braces. Propulsion will be by a 4-cylinder triple expansion vertical inverted steam engine driving a single bronze propeller. Steam will be supplied by four single ended cylindrical return tube Scotch boilers using coal as fuel although it is probable that provision will be made also for the storage and burning of oil for fuel.

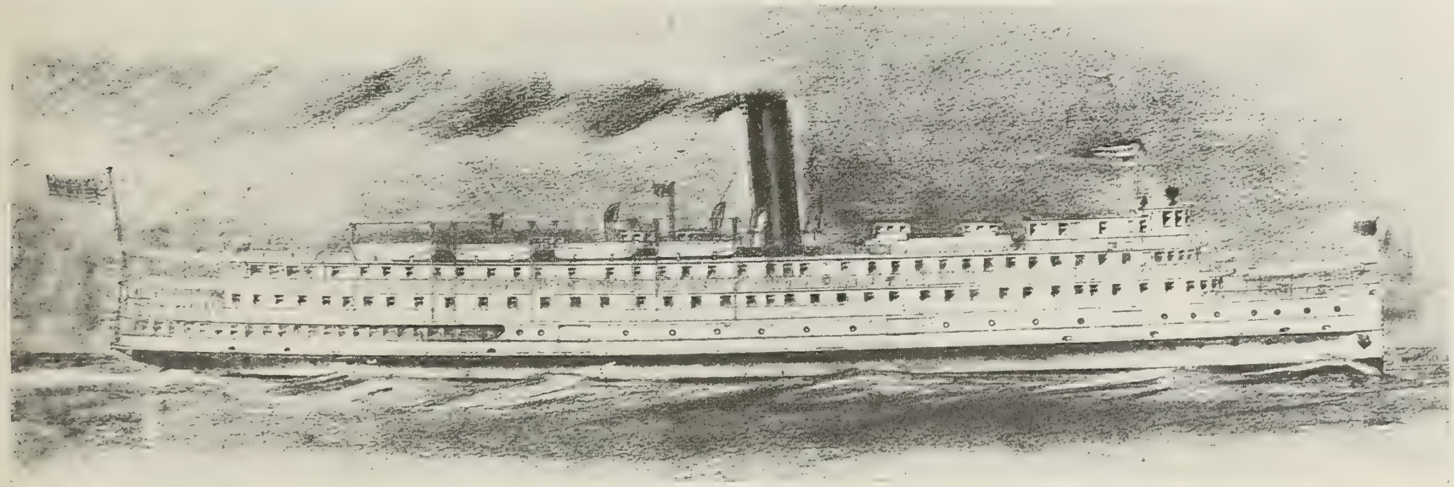
There will be 175 staterooms all heated by steam and provided with sanitary metal beds, and other incidental stateroom equipment. Special bedrooms are arranged ensuite with private bathrooms while others have showers and Pullman accommodations.

Ample space will be provided on the lower deck forward for carrying perishable cargo in cold storage and a large refrigerating plant will be installed.

The vessels will be subdivided by watertight bulkheads and equipped with fire fighting and life saving apparatus, required by the latest rules of the United States Steamboat Inspection Service for the safety of passengers and the vessels. Various other modern features will be provided to give the steamers the maximum of efficiency, safety and comfort.

The request for $4,500,000 for the construction of six seagoing dredges, fully equipped, is reported from Washington to be already "In committee" and action is looked for in the near future.

According to the latest design of dredge for use by the United States Engineer Department on bar dredging, the general specification provides for a length overall of 247 feet 3 inches with a beam, molded, of 46 feet, the boats to have four hoppers with a total capacity of 1,250 cubic yards. The vessels will be equipped with two triple expansion engines, 15 by 26 by 44 by 26.



Official Sketch Showing Type of Steamer to Be Constructed by Pusey & Jones for Seaboard-Bay Line

Five Million In New Special Type Ocean and Lake Freighters Considered For Construction In Eastern Yard

Central Steamship and Commerce Corporation Contemplates Building Fifteen 257-Foot Diesel Electric Cargo Boats to Run Between New York, West Indies and Great Lakes

THE construction of fifteen ships, having an estimated cost of close to $5,000,000, is contemplated by the Central Steamship & Commerce Corporation, 30 Broad Street, New York City, according to official information obtained by Marine Engineering and Shipping Age. Plans and specifications for these vessels, which are to be Diesel electric boats for service through the Welland Canal and the New York Barge Canal between New York and Chicago and also to the West Indies when canal traffic is closed, are being prepared by Theodore D. Wells, naval architect and marine engineer, 11 Broadway, New York.

Preliminary plans provide for the construction of a special type of ship, built of steel, 257 feet over all length, 42 feet beam, 18 feet deep and equipped with Diesel engines developing 1,300 horsepower. There will probably be two generating sets and one motor and all auxiliaries on the vessels will be operated by electricity. There will be two refrigerating holds with refrigerating machinery of about 70 horsepower. The ship will develop a speed of about 10 knots loaded. Each vessel will be equipped with two cargo masts forward and two aft.

Contract Is Placed for New Steel Coal Carriers

Contract for the construction of four steel cargo ships has been awarded to Fraser Brace & Company, Ltd., Montreal, Can., with which the New York Harbor Dry Dock Company is connected, the work to be done at Trois Rivieres P. Q. The ships are to be coastwise coal freighters for the George Hall Coal Company of Montreal.

The vessels will be 250 feet in length between perpendiculars, 43 feet molded beam, and 20 feet 6 inches deep, built partly on the Isherwood plan. They will be 2,450 net tons and will be propelled by triple expansion reciprocating engines of 1,400 indicated horsepower. Steam will be supplied to the vessels by 2 single ended Scotch boilers carrying about 200 pounds pressure. They will be coal burners.

Each ship will be equipped with electric lighting plant and a refrigeration system of a type not yet decided upon, and deliveries will start in June.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

To be Oil Burner, Boston, Mass.—United Fruit Company steamer Carrillo has been withdrawn from Boston service in order to be converted into oil burner.

New Lake Passenger Ships, Buffalo, N. Y.—Cleveland & Buffalo Transportation Company is considering construction of two palatial passenger ships for Great Lakes service, to be about 600 feet in length.

Ship Contract Award, Wilmington, Del.—Contract for construction of two 330-foot freight and passenger vessels for Seaboard-Bay Line awarded to Pusey & Jones; to cost about $2,000,000.

Sea Dredges, Washington, D. C.—Request for $4,500,000 for construction of six seagoing dredges fully equipped is now "in committee" at Washington and action upon it is expected shortly.

Oil Barge, New York.—Army Engineers Office, 39 Whitehall street, will open bids about March 15 for construction of steel oil barge with necessary equipment for use as supply boat in harbor to Government oil burning drill boat already under contract. Length, 85 feet, 2,200 barrels capacity; about $25,000.

Ships to Be Refitted.—Plans are now being drawn for refitting, with additional oil tanks and refrigeration facilities, the 535-foot Shipping Board steamers American Legion and Southern Cross, operated by the Munson Line.

Reconditioning Contract, Oakland, Cal.—Oliver Olson let contract for steamer Ghislaine to Moore Shipyards for engine repairs, $8,750, and Hanlon Dry Docks for hull repairs and painting, about $22,000.

Steamer Reconditioning, Baltimore, Md.—American-Hawaiian Line steamer Pennsylvanian undergoing extensive repairs at Bethlehem plant.

To Electrify Dredges, Portland, Ore.—Plans and specifications are being prepared for the electrification of one or more dredges operated by Port of Portland. James Polhemus, port manager.

Ship Conversion, San Francisco, Cal.—A. DeYoung was low bidder for conversion of the West Lewark from a freighter into army transport to replace Army transport Dix. Work includes tearing out of large part of inside construction, installation of bunks and stalls for horses and mules; $65,617.

Collision Repairs, Philadelphia, Pa.—Wm. Cramp & Sons Ship & Engine Building Company was low bidder for repairs to steamer Danholm at a price of $3,990 and five days.

Reconditioning Contract, Brooklyn, N. Y.—Robins Dry Dock & Repair Company was awarded contract for Shipping Board steamers Lone Star State and Peninsula State; $84,000.

New Liner for Lakes, Port Arthur, Ont.—Canadian Pacific Railway Company reported to be negotiating with Port Arthur Shipbuilding Company for construction of large lake passenger ship.

Diesel Engines, Auburn, N. Y.—The McIntosh & Seymour Corporation has been awarded contract for ten 150 brake horsepower Diesel engines for installation in new packets designed by R. R. Livingston, for Canal & River Transportation Company, New York.

Liner Overhauling, Seattle, Wash.—Steamer Admiral Watson, of Admiral Line, plying in Seattle-Alaska trade will be laid up for a month to undergo annual overhauling and inspection.

Schooners, San Francisco, Cal.—Three schooners purchased in France by Oliver Olson are en route to San Francisco to undergo reconditioning for lumber trade.

Contract Award, Newport News, Va.—The Newport News Shipbuilding & Dry Dock Company received contract for extensive reconditioning of steamship Leviathan to cost $6,110,000. Together with other items total cost will be $8,200,000.

New Lighter, Cleveland, Ohio.—Plans for modern lighter to replace the Newman, recently wrecked, will be started immediately by Great Lakes Towing Company.

May Convert Steamer, Portland, Maine.—Wooden steamer Bassan, built and equipped for Emergency Fleet Corporation during war at price of $700,000 and recently sold at sheriff's sale for debt of $6,000, has been purchased by R. W. Page, Skowhegan, Me., who considers repairing and recommissioning her as steamer with alternative plan of converting her into five-masted schooner.

Large Repair Jobs, San Francisco, Cal.—Moore Shipbuilding Company, Oakland, awarded contract for reconditioning Pacific Mail liner Empire State, including changes in officers' and crew's quarters, ventilation system, installation of new feed fuel pipe and other work, all amounting to $38,000. Steamer Supply awarded to Crowley Shipyards for boiler and engine repairs, etc.; price $38,000.

Cargo Ships, Three Rivers, P. Q.—Fraser-Brace & Company, Ltd., Montreal, Can., received contract for construction of four steel cargo ships to be used in coastwise coal trade of George Hall Coal Company, Montreal. Dimensions, 250 feet length between perpendiculars, breadth, 43 feet molded, and 20 feet 6 inches deep, built partly on Isherwood plan, and of 2,450 tons net.

Additional Accommodations for Liners, New York.—Plans and specifications are under consideration for addition of 1,200 third class passenger accommodations on steamer Princess Matoika, to cost about $100,000. Steamers Hudson and Potomac also listed for similar additions.

Steamer Repairs, San Pedro, Cal.—Steamship Harvard drydocked at Los Angeles Shipbuilding Company plant for repairs to frame and general overhauling; price $38,500.

General Repairs, Newport News, Va.—Shipping Board officials are planning to get perhaps sixty of "lake" type vessels down from Camp Eustis' idle fleet for general repairs prior to being placed in Cuban sugar trade.

Towboats, Rondout, N. Y.—Hildebrant Dry Dock Corporation has contract for construction of three 70-foot wood towboats, propelled by 240-horsepower Diesel engines furnished by New London Ship & Engine Company.

Will Recondition Steamers, New York.—Ward Line plans reconditioning of steamers Orizaba and Siboney now plying in Cuban service.

New Passenger Steamer, San Francisco, Cal.—Inter-Island Steam Navigation Company, Honolulu, T. H., called for bids for 360-foot express passenger steamer of 16½ knots.

New Cable Ship, New York.—Plans and specifications have been completed by Cox & Stevens, 25 Broadway, for construction of cable steamer, bids for which will open on or about March 1. Ship will be about 169 feet in length and cost approximately half a million dollars.

Shipping Board Repair Work.—The Shipping Board is taking out of "lay-up" at least ten steamers to be repaired and made ready for call. Cost about $50,000. Steamship Susquehanna to be reconditioned, about $15,000.

Tug Repairs, Brooklyn, N. Y.—Clinton Dry Docks, Inc., were awarded contract for reconditioning United States Shipping Board ocean-going tug Butterfield at price of $13,900.

To Repair Dredge, New York.—Standard Shipbuilding Corporation, Shooters Island, N. Y., was low bidder for job of reconditioning Government seagoing dredge Atlantic at price of $18,500.

Boat Contract, Collingswood, Ont.—Collingswood Shipbuilding Company received contract from T. Dick, Jr., president of National Sand & Material Company, for construction of sand and gravel carrier of 2,000 cubic yards capacity.

Repair Contract, Brooklyn, N. Y.—Old North State awarded by the Shipping Board to the Morse Dry Dock & Repair Company for repairs amounting to $24,950.

Fireboat to be Equipped, Norfolk, Va.—City plans outfitting fireboat Quaker No. 2 to make her efficient as a fire fighter. Boat is in good order and only requires a few changes in her mechanism for installation of equipment. Fire underwriters urge that work be done immediately.

To Buy Steamers, San Francisco, Cal.—S. A. Perkins, president of Alaska Transportation Company, a new firm, is reported to have come from Tacoma for the purpose of negotiating for purchase of three steamers for the passenger and freight service which the company will engage in to Alaska.

May Purchase Vessel, Hampton Roads, Va.—Representatives of A. H. Bull & Company were here recently inspecting laid-up ships of "Lake" type with view of purchasing one from the Shipping Board.

PORT IMPROVEMENTS

Large Terminal, Beaumont, Tex.—Santa Fe Railroad system is reported as planning to establish its own terminal on Beaumont waterfront in order to facilitate rapidly increasing tonnage handled. Several sites on Neches River are also being considered. Project will cost approximately $1,000,000.

Pier Extension, San Francisco, Cal.—Work will soon be started on extension of Pier 22, occupied by Charles Nelson Company. Three hundred feet of pier space will be added at estimated cost of $140,000. Harbor board also contemplates lengthening Pier 34.

Docks, Etc., Cape May, N. J.—Progressive League selected site at Cape May Point Boulevard for erection of docks and a ferry house to be used by New Jersey-Delaware ferry.

Terminal Expansion, Wilmington, N. C.—Standard Oil Company reported to be planning doubling capacity of its terminals.

Canal, Etc., Port Arthur, Tex.—G. N. Bliss, chairman of Chamber of Commerce, reports project of deepening canal from gulf to Beaumont to depth of 30 feet in canal and 32 feet over bar with bottom width of 125 feet in Sabine-Neches canal, and 300 feet at jetty; about $1,795,000.

Pier Extension, Tacoma, Wash.—Plans are now under consideration by Port Commission to equip harbor with largest exclusive lumber pier in United States. Present pier will be extended 400 feet, giving structure total length of 1,200 feet; about $90,000.

Terminals, Portsmouth, Va.—City Manager Jervey plans construction of municipal terminals.

Sea Wall, Cocoa, Fla.—City contemplates construction of sea wall entire length of water front. Address the mayor.

Dredging, Baltimore, Md.—City plans dredging 800-foot channel at foot of Eutaw and Alluvian streets, Spring Gardens, 75 feet wide and 17 feet deep. About 20,000 cubic yards of material will be excavated; about $100,000. B. Hill, harbor engineer.

Ferry Slips, San Francisco, Cal.—Golden Gate Ferry Company preparing plans for construction of ferry slips in Sausalito and on State property on San Francisco waterfront for use of its automobile ferry line.

Ferry Terminals, Oakland Cal.—Six Minute Ferry Company plans construction of terminals at Oakland and San Francisco for automobile ferry line.

Pier, Philadelphia, Pa.—Philadelphia, Baltimore & Washington Railroad Company plans construction of pier and four pile clusters inside bulkhead line in front of their property on west bank of Schuylkill River; about $10,000.

Ferry Terminals, Haverstraw, N. Y.—A new ferry service will soon be inaugurated by E. N. Goodhall, of Alburgh, Vt., head of Lake Champlain Ferry Company, between Haverstraw and point on Hudson River directly opposite. Company plans construction of bulkhead and slips and dredging terminals to sufficient depth to permit docking of ferryboats.

Jetty, Longport, N. J.—Construction of stone jetty planned at entrance to Coldspring Inlet and Cap May harbor; about $100,000.

Pier Equipment, Etc., Tampa, Fla.—$1,000,000 bonds issued to cover cost of contemplated port improvements, including pier 870 feet long with shed and equipped with modern cargo handling machinery. A. W. D. Hall, city engineer.

Jetties, Dredging, Etc., Fort Lauderdale, Fla.—Broward County Commissioners plan extensive harbor improvements, to include cutting of the bar opposite mouth of New River, building jetties, and dredging basin in New River Sound; $100,000 bond issue.

Wharves, Houston, Texas.—City let contract to Charles K. Horton to build additions to cotton wharves on north side turning basin; building a shed 100 by 800 feet, and laying track between widened platforms; price, $107,450. J. C. McVea, city engineer.

River Terminal, Louisville, Ky.—Construction of river terminal contemplated. Huston Quinn, mayor.

Docks, Mobile, Ala.—City will soon vote on bonds for construction of docks and other terminal improvements. Address the mayor.

River Landing, Vicksburg, Miss.—City will vote May 9 on $80,000 bonds for construction of river landing. Address the mayor.

Improve Harbor, Richmond, Cal.—United States Government will soon let contract for construction of retaining wall and dredging of harbor.

To Remodel Docks, Houston, Texas.—City plans remodeling of cotton docks to cost about $115,000. J. C. McVea, city engineer.

Wharf, Etc., Petersburg, Fla.—City contemplates deepening Bayboro harbor to 18 feet and building 600-foot wharf. Bond issue, $100,000. Address the mayor.

Seawall, St. Augustine, Fla.—City Commissioners have prepared tentative plans for extension of seawall out to deep water mark.

GOVERNMENT WORK

Dredging, Key West, Fla.—United States Engineer Office, Jacksonville, will receive sealed proposals until 12 M., March 14, for dredging in Key West harbor. Further information on application.

Dredging, Nashville, Tenn.—War Department, Lieutenant-Colonel J. R. Slattery, Box 900, will dredge between municipal terminal and channel proper at Cumberland River; about $15,000.

Harbor Survey, Charleston, S. C.—War Department making surveys in Town Creek and over Cooper River between Navy Yard and Army Base, as part of general plans for future work in improving harbor. Major G. R. Young, U. S. A., engineer.

Dredging, East Boston, Mass.—Specification 4552. Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded contract to Bay State Dredging & Construction Company, 62 Condor street, for dredging Goat Island at price of 72 cents per cubic yard, scow measure in place, or total of $8,500.

Specifications, Washington, D. C.—Following specifications are available at or in contemplation by Bureau of Yards and Docks, Navy Department, Washington, D. C., for various work or material as follows: Ordnance Station, Puget Sound, Wash., addition planned to building 368, specification 4577; heating system, Sayville, N. Y., planned in radio station, specification 4578; gun shed and stable, San Diego, Cal., construction planned for Marine Corps Base, specification 4579.

Pumping Unit, Chesapeake City, Md.—United States Engineer Office, Wilmington, Del., will receive sealed proposals until 11 a. m., March 20, for furnishing and installing one complete pumping unit, consisting of centrifugal pump directly connected to engine, etc. Further information on application.

NEW INCORPORATIONS

The Progressive Steamship Company has been incorporated with a capital of $200,000, at Dover, Del. Charles T. Magee and Ward C. Henry, of Philadelphia, and Henry D. Smith, of Atlantic City, are among the incorporators.

The Piermont Navigation Company, New York, has been incorporated by Theo. L. Ernst, S. E. Freeland and Samuel Baras, all of New York. The American Guaranty & Trust Company is agent.

The Atlantic Mail Corporation, Manhattan, has been incorporated with a capital of $500,000 to engage in commerce and navigation. E. N. Abbey is incorporator.

The China America Steamship Corporation, Manhattan, has been incorporated by F. Kiers, 540A Henry street, Brooklyn, N. Y., with a capital of $150,000, to engage in commerce and navigation.

The Quebec Shipbuilding & Repairing Company, Ltd., Quebec, Can., has been incorporated under the Dominion Companies Act, with a capital of $500,000, to carry on a general shipbuilding, repairing, chartering and navigating business; to own and operate ships, dry docks, shipyards, etc.

The Republic Navigation and Transportation Corporation, Wilmington, Del., has been incorporated with a capital of $1,750,000, to build, own and operate boats.

The Asiatic American Steamship Company has been incorporated at Portland, Oregon, with a capital of $100,000, to own and operate boats.

FOREIGN ACTIVITIES

Quay Extension, Ghent, Antwerp.—Projected improvements at the port will increase Scheldt quay to 10,000 meters. A 70-ton floating crane is contemplated.

Naval Construction Program, Spain.—Council of ministers approved naval construction plans for modernizing all type of war vessels, increasing tonnage of torpedo boats and building scout cruisers of 8,000 tons each.

Shipbuilding, Norway.—Norway is developing its shipbuilding resources and now has eight sizable shipyards. The Rosenberg Mek Verksted at Stavanger is making pretentious additions.

Harbor Improvements, Denmark.—Copenhagen Government introduced into Danish Folketing proposal to grant 4,564,000 kroner for extension and improvement of Slesvig harbors at Hardersley, Aabenraa, and Sonderburg.

Intermediate Type Ships, Italy.—It is anticipated that Bellotti scheme for building intermediate type vessels for use on certain agreed lines in Italy under Government subsidy will become law. This should provide employment for Italian shipyards during coming year and serve to stem heavy increase in number of unemployed.

New Shipbuilding Company, Austria.—Austrian Shipyards Company, formed with purpose of rebuilding Austrian mercantile marine, has been registered at Vienna under auspices of Kredit Anstalt and Hamburg American Line. Majority of shares to be in Austrian hands, with Hamburg American interested to extent of 10,000,000 crowns.

Diesel Engines, England.—Vickers, Ltd., Barrow-in-Furness, are reported to have received orders to construct Diesel engines for minelayer to be built in one of Government dockyards.

Barge, England.—Contract for construction of self-propelled barge was awarded to Vickers, Ltd., Barrow-in-Furness, by Furness Railway Company.

New Freight and Passenger Steamers, England.—Cammel-Laird & Company, Ltd., Birkenhead, has order from Alfred Holt & Company for construction of 11,000-ton freight and passenger vessel to be a twin-screw and gear driven. The Holt Company also awarded contract to Scott's Shipbuilding & Engineering Company for a twin-screw steamer, 400 feet in length.

Launchings, Etc., England.—Harland & Wolff during year 1921 are reported as having launched eight vessels of 69,753 gross tons, and completed propelling machinery representing 59,600 indicated horsepower.

England-Australia Service. — Commonwealth Government Line has inaugurated fast steamship service out of London to Australia. Five new steamers of uniform design and speed and of 14,000 tons each will ply in this service.

Cargo Vessels, Germany.—Danziger Werft, according to report, has secured large foreign orders requiring employment of 1,200 additional workmen. Among orders are two 2,000 ton cargo vessels for Chilian Government to be ready in six months. It is proposed to convert the concern into company with the participation of international capital.

Capital Increase, Germany.—North German Lloyd, at meeting in Berlin, increased its capital to 600,000,000 marks, an increase of 125,000,000.

Shipbuilding Output, Germany.—Lloyd's Register reports the launching in German shipyards of 509,064 gross tons, or 42,000 tons more than the gain for all other countries than America and Great Britain, so that the minor nations, excluding Germany, showed an actual loss on the year's output. German returns show that the shipyards of Germany have now more than regained their pre-war production as their previous record year for launchings was in 1913 when tonnage launched aggregated 465,000 gross tons.

Steamers Remodeling, Germany.—The steamers Resolute and Reliance recently acquired by the United American Lines will be extensively remodeled at Hamburg. Passenger accommodations will be cut in half to add conveniences for second and third class passengers. Thirty additional second cabin rooms will be added.

New Shipping Company, Germany.—The Deutsch-Skandinavishe Reederei, A. G., a new shipping company, has been organized at Hamburg, with a capital of 7,000,000 marks to carry on trade between Germany and Scandinavia.

Diesel Engines, Japan.—Japanese Government recently placed order with Sulzer Brothers for Diesel engines to be installed in new submarines. The engines are to be 4,000 horsepower, and each vessel will be equipped with engines aggregating from 16,000 to 20,000 horsepower; about £1,250,000.

New Vessel, China.—Ningpo-Shoashing Steamship Navigation Company has announced capital increase of $500,000, which will be used for construction of large vessel for the Yangtze service.

Steam Launches, China.—It is reported that Yuan Chaoching, of Tzo-chuen, Shantung, plans construction of four steam launches to establish service along Sing-Ching-Ho from Wang-tan-jao to Yang-kao-kiu by way of Wu-ho.

Harbor Development, Japan.—The municipal authorities of Tokyo are reported to have decided to construct a harbor at an estimated cost of Y.350,000,000.

New Shipyard, Japan.—The Kawasaki Dock Company plans construction of a shipyard near Kokura. Capacity of the new dockyard contemplated will be so large that a merchant or war vessel of any size now afloat will be accommodated.

Motorship Construction, Germany.—The Deutsche Werft, Hamburg, has received from a firm in Christiania, Norway, contract for construction of three motorships of from 8,000 to 9,000 tons each. They are of special design and will be used to carry frozen meat from Australia to Argentine.

Large Harbor Project, Italy.—John R. MacArthur, of MacArthur Brothers, New York, has signed a contract with the Italian Government for extensive improvement of Palermo harbor, Sicily, including dredging, construction of sea walls and moles. An Italian company will be formed to undertake the work, which will require about ten years. American machinery will be imported.

New Steamer, China—The Ping An Dockyard, Shanghai, is building a steel vessel, the Singpaohua, which will be ready for launching this spring. When completed, vessel will be placed in service between Shanghai, Chow-shan, Haimen and Shih-poo.

New Shipping Enteprises, Germany—A new shipping organization to be known as Deutsch-Skandinavische Reederei A.G., with a capital of 7,000,000 marks, has been formed at Hamburg to carry on trade between Germany and Scandinavia. At Geestemunde another shipping enterprise, the Ubersee Reederei, has been formed with a capital of 7,500,000 marks.

Bill for Conversion of 112 Ships Into Motor Vessels Is Before Congress

Honorable Harry C. Gahn, of Cleveland, Ohio, introduced a bill in the House of Representatives, on February 21, 1922, to authorize and direct the Secretary of the Treasury of the United States to issue legal tender money to purchase from and pay therefor the United States Shipping Board Emergency Fleet Corporation for 112 Submarine Boat Corporation type vessels of about 5,375 deadweight tons each, totaling about 602,000 deadweight tons, and contract for converting such vessels into motorships in order to assist in providing and expanding an American merchant marine.

Sun Shipbuilding Company Is Low Bidder for New Steamer

Of the fifteen companies submitting tenders, the Sun Shipbuilding Company of Chester, Pa., with a price of $1,027,000, was low bidder for the construction of a 360-foot express passenger steamer for the Inter-Island Steam Navigation Company, Honolulu, T. H. The Newport News Shipbuilding & Dry Dock Company was second lowest with a bid of $1,100,000. The vessel will be used in the company's inter-island trade and will have a speed of 16½ knots.

BUSINESS NOTES

The United States Navigation Company, general agents of the Reardon Smith Line, Ltd., in New York, has moved its offices from 66 Broadway to the Whitehall Building, 17 Battery Place.

The Boston office of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has been moved from the Columbian Life Building, to rooms 403 and 404 Harvey Building, Chancy St., with Mr. C. W. Yerger as manager.

The Wilson Welder & Metals Company has moved its general offices and Bush Terminal factory to 132 King Street, New York City.

The Philadelphia office of the Hauck Manufacturing Company, manufacturers of portable oil burners, torches, furnaces, etc., has been moved to 1726 Sansom Street. Mr. Herbert Vogelsang will be in charge.

H. B. Price, formerly advertising manager of the Belden Manufacturing Company, Chicago, has joined the advertising agency of George J. Kirkgasser & Company. Mr. Price will specialize in electrical and technical advertising and in addition to an engineering education brings to his new work a wide practical experience in engineering, construction, sales and operation.

The Pneumercator Company, Inc., announces the removal of its general offices from 15 Park Row, New York City, to 40 Flatbush Avenue Extension, Brooklyn N. Y.

The firm of Cox & Stevens, naval architects, ship surveyors and brokers, will move on March 1 to their new offices in the Cunard Building, 25 Broadway, New York. Their new quarters are directly accessible from the Morris Street entrance and will be sufficiently large to accommodate, in addition to the executive staff, their designing force which for several years past was located in Brooklyn.

TRADE PUBLICATIONS

Iron Workers Tools.—The Scully Steel and Iron Company, Chicago, is sending out a somewhat elaborate pamphlet showing iron workers' tools for hand and pneumatic work. The tools are made especially for boiler makers and iron workers and include hammers, sledges, chisels, punches, rivet snaps, side sets, calking tools, drift pins, rippers, beading tools and the like. This pamphlet will be sent to any one upon request.

Sprague Electric Dynamometers.—The Sprague Electric Works, New York, has published a well illustrated circular describing the construction, control and application of the research type of the Sprague electric dynamometer which is a highly accurate and easily operable apparatus for the measure of torque or power.

New Quigley Pulverized Fuel Bulletin.—A new bulletin on the Quigley Fuel Systems, comprising methods of preparing, transporting and burning of pulverized fuels has just been published by the Hardinge Company, 120 Broadway, New York. This bulletin is known as No. 12 and treats the subject of pulverized fuels in a manner never before attempted. One of its distinguishing features is the fact that emphasis is laid upon the methods employed to properly prepare and burn the powdered coal, rather than occupying most of the space discussing the pulverizer. Aside from complete plant layouts, what the manufacturers term as a "Unit Milling Plant" is described. This layout is radically different from anything ever before developed. The System comprises a method of pulverizing and transporting the coal to one or more furnaces in the same locality, at the same time securing positive regulation and continuous operation over extended periods. The cost of this unit is but a fraction of that of the larger Systems where the coal must be transported several hundred feet to a number of furnaces. The range of capacity for the complete pulverized fuel plants is extreme.

Auxiliary Motor Control Equipment.—A bulletin containing data pertaining to marine motors and controllers for engine room auxiliaries and deck machinery on merchant ships is being distributed by the General Electric Company, Schenectady, N. Y. to assist marine engineers in their work. Concise information is given relative to horsepower, voltage, speed, weights, and approximate dimensions of standard type marine motors.

Deschanel Cableways.—A bulletin on cableway methods of handling coal and similar materials from barge or railroad car direct to storage piles or to the power house has been sent out by the Deschanel Engineering Corporation, 90 West Street, New York. Ashes can be removed from a plant by the same equipment, which consists essentially of a two-drum reversible hoist, a clam-shell type cableway bucket, and a cableway and supporting towers. Diagrams and photographs showing typical installations are given.

Boiler Tube Production.—The processes of manufacturing seamless and lap welded steel boiler tubes employed by the National Tube Company, Pittsburgh, Pa., are described in a bulletin recently issued by the company. The physical properties of these tubes are given as well as the tests and inspections necessary for their acceptance. A series of tables containing data valuable to tube users is included in the bulletin, which is of considerable interest.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers

Navy Department, Washington, D. C.
President—Capt. A. J. Hepburn, U. S. N.
Secretary-Treasurer—Commander J. S. Evans, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers

29 West 39th Street, New York.
President—Walter M. McFarland.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers

29 West 39th Street, New York City.

United States Naval Institute

Naval Academy, Annapolis, Md.
President—Rear Admiral Bradley A. Fiske, U. S. N.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

National Association of Masters, Mates and Pilots

National President—John H. Pruett, 423 Forty-ninth St., Brooklyn, N. Y.
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Draftsmen

President—E. H. Monroe, Washington, D. C.
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association

Headquarters 311-315 Machinists Building, Washington, D. C.
President—Wm. S. Brown.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association

1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association

11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association

149 Broadway, New York
President—C. H. Potter

CANADA

Grand Council N. A. of M. E. of Canada

Grand President—E. Read, Rooms 10-12, Jones Building, Vancouver, B. C.
Grand Vice-President—Jeffrey Roe, Levis, P. Q.
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects

5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland

39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders

Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated

The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

Via Carlo Alberto 18, Genova.

Marine Engineering and Shipping Age

Volume XXVII | April, 1922 | Number 4

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
S. M. PHILLIPS, Associate Editor L. S. BLODGETT, Associate Editor
W. Z. GARDNER, News Editor

Contributing Editors

Rear Admiral C. W. Dyson, U. S. N.
Commander S. M. Robinson, U. S. N.
Professor C. H. Peabody
Captain C. A. McAllister, U.S.C.G. (Retired)
William Gatewood
H. McL. Harding
William T. Donnelly
James L. Bates

WE GUARANTEE that of this issue, 5,350 copies were printed; that of these copies, 4,059 were mailed to regular paid subscribers, 337 were provided for counter and news company sales, 212 were mailed to advertisers, 27 were mailed to employees and correspondents, and 715 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 21,800—an average of 5,450.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Asscciation and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

The President's Plan

It is now a full month since the President submitted his well balanced plan for establishing our merchant marine.

He is to be congratulated on the fact that, although this plan contains many forms of indirect aid as well as a subsidy, no one has been able to suggest any better way to develop our shipping. Few if any cases of proposed legislation have been so admirably framed to disarm criticism and few cases are on record where the necessary legislative steps have proceeded so rapidly to carry out a President's recommendations.

The reason for this lies in the provisions that are made in the plan to benefit the exporter and importer, as well as the shipowner, to encourage the construction of ships as well as their operation, and to build up a naval reserve, thus insuring an efficient support for our warships as well as a highly trained better paid class of seamen. In fact, the President's message is more than a plan, *it is the greatest "selling" argument for an American merchant marine that has ever been presented to the American people.*

It is a selling argument to the shipper, the manufacturer or the producer, whether he exports or imports finished or raw materials, for it is plain even "to the man on the street" that whosoever routes his traffic under this plan in American bottoms may make a straight deduction of 5 percent of the freight money that he pays from his income tax.

It is a selling argument to the shipowner and the prospective shipowner for it guarantees him, in the direct subsidy, the same kind of protection against cheap foreign labor that has built up our other industries. Strange as it may seem, the shipowner, or the prospective shipowner, is the most important man to be convinced that the merchant marine can be made a profitable business for otherwise *he will neither buy nor build the ships* that are needed to adequately represent us on the Seven Seas.

It is a selling argument to the shipbuilder for it provides for a large construction loan fund at a cheap rate of interest, making it possible for responsible parties to borrow the money to construct the most modern and efficient vessels of the types that we lack, such as fast passenger and mail liners, motorships and refrigerator ships. It provides exemptions from taxes, if the money is spent in new construction in American yards. But most of all it specifies that except in very special cases no benefits under this plan will go to vessels other than *those built in our own shipyards.*

It is a selling argument to good American seamen for it assures them an American standard of wages through the creation of a naval reserve. Their uniform will bring them a certain glory and a certain respect that only those who stand ever ready to serve their country in time of need can ever expect. It is due more to this practice of England than anything else that has caused *her best type of citizens to follow the sea.*

It is a selling argument to all patriotic Americans for they cannot have forgotten how the cry went out "for ships and more ships" when the deadly submarines were at their nefarious work. They know right down in the bottom of their hearts that an adequate naval reserve of merchant ships is absolutely necessary for *the very safety of their country.*

It is a selling argument to the taxpayer for it provides a close check on the profits of the shipowner and for the return to the Treasury of excess earnings. Not only this, it provides an opportunity for the Government to sell its ships which

can be nothing else than a heavy drain on the Treasury as long as they remain idle. In fact, under this plan the *Government should take in more money from the sale of its ships than it pays out* in subsidies for some years to come.

The President has done his part, Congress will no doubt follow suit but the great mass of people do not read a presidential message as closely as they should. The Shipping Board and the shipowners who know how much benefit the whole country will receive from a merchant marine should get together and devise some means of spreading the gospel of shipping throughout the nation.

The Cost of Supporting Foreign Shipping

COMMISSIONER George E. Chamberlain of the Shipping Board gave some very interesting figures in a recent speech before the National Merchant Marine Association on the amount of money that foreign shipping interests had taken out of this country. Perhaps if the newspapers which have repeatedly suggested in their editorials that if foreign ships could carry our cargoes cheaper than American vessels it would be good business to let them do so, and that it would, in fact, help those countries to pay up their debts, were aware of the stupendous sums that we have paid for transportation, they would not let insidious foreign propaganda bias their judgment again.

Commissioner Chamberlain's figures, obtained from the Department of Commerce, show that during the six years ending December 31, 1920, the total value of our exports and imports was $47,626,671,810, and of this amount $12,129,630,431, or 26 percent of the total, was carried in American vessels. Foreign ships, on the other hand, carried commerce valued at $35,497,041,379, or about 74 percent, and of this amount, Great Britain carried $19,811,387,710, or about 42 percent of the total commerce. Taking 25 percent of the total value of the commerce as a conservative estimate of the cost of freight, banking, insurance, etc., paid out for foreign services, the money actually going out of this country to enrich foreign shipping interests in the last six years amounted to $8,874,260,345.

Although it is difficult for us to appreciate the immensity of the vast sums that must be paid out for transportation of our commerce, it requires no stretch of the imagination to note that the $8,874,260,345 paid to foreign shipping in the last six years would come pretty near to cancelling the total allied war debt to us and that in the event that we fail to properly develop our merchant marine a much smaller sum than this expended on foreign shipping every six years would more than pay our entire national debt in far less time than America, rich as she is, can possibly hope to liquidate it.

Those who advocate allowing foreign ships to handle our commerce, providing they can do it cheaper, and who think that the amount of money involved is of no relative importance would get a truer perspective of the necessity for an American merchant marine, if they would compare the total savings deposits of approximately $6,000,000,000 which represents the lifetime accumulations of our working people with the nearly $9,000,000,000 expended on foreign ships in six years.

If this is not enough to impress any fair minded American with the vastness of the sums that a merchant marine of our own would retain in this country, let him stop to consider the fact that the total amount of cash expended by the Federal Government to date on the improvement of its rivers, harbors, canals, including the Panama Canal and its fortifications, is only $1,515,931,141.33—a sum which foreign ships would carry away in three or four years of normal trade.

Commissioner Chamberlain says that he does not think that it is an exaggerated statement to say that foreign interests have been enriched by over twenty-eight billion dollars by carrying American commerce in their ships during the last one hundred years notwithstanding the fact that we carried a very large portion of our commerce in our own ships up to 1860. Outside of the many other valid arguments for an adequate merchant marine, the amount of money that our own ships can retain in this country is an ample reason for supporting the President's plan of Government aid to our merchant shipping.

Shipping Bill Making Progress

AS a result of the efficient cooperation of the Shipping Board with the Senate Committee on Commerce and the House Committee on the Merchant Marine and Fisheries, there was introduced in both Houses of Congress, on the same day that the President delivered his message, identical bills to amend and supplement the Merchant Marine Act of 1920 embodying the Administration's recommendations for the purpose of aiding and establishing our merchant shipping.

This close cooperation was possible because the President was assisted in the preparation of his message by the facts bearing on our merchant marine that had been collected by the United States Shipping Board who in turn had been assisted by committees consisting of eleven of the best known shipping experts in this country. It is a striking tribute to the broad minded character of the personnel of the Shipping Board, composed as it is of three Democrats and four Republicans, that the findings presented to the President received the unanimous support of that body. Few, if any, know the politics of the eleven experts and it is said that the board itself was ignorant of the political affiliations of its advisers.

Thus the Shipping Bill, which is analyzed on page 219 of this issue, has been constructed by men having the patriotic purpose of securing the best information possible relating to marine matters from the best possible sources. That the work was well done is evident from the unqualified endorsement of the President's message by the convention of the National Merchant Marine Association on March 4. At this convention, which was attended by prominent men representing all branches of shipping, no criticism of the provisions of the Shipping Bill were made although one session was an open forum maintained for the very purpose of debating the provisions of this bill.

There are always bound to be honest differences of opinion in any group of people as to the best means to accomplish a great object and shipping men in the past have been no exception to this rule. However, the necessity and demand for an immediate decision on a constructive marine policy has become so great that criticism of the Administration's plan demands a suggestion of something better. It is a good bill and the indications are that it will receive the support of both Republicans and Democrats.

The Cart Before the Horse

THE natural way for a country to develop its merchant marine is to establish merchandising and banking connections abroad and then to construct its ships as fast as they are needed to handle the business obtained. The reason that this method has not been applied to any large extent by this country in the past lies principally in the far greater rewards offered to capital for domestic investment.

It was hardly to be expected, with the opportunities for exploiting our natural resources or engaging in our highly protected industries, that capital could see any attraction in shipping—our one and only free trade experiment. We did not realize that our periodical business depressions were in a large part due to the backing up of surplus products that could have been marketed in foreign countries, if we had had the business connections and an adequate merchant marine to dispose of our excess production.

Of course, if it had not been for the war we would not have built our great fleet before establishing business connections throughout the world; thus getting the cart before the horse. But we have the ships now—ready for business—and we have got to develop the traffic for them or suffer a heavy deficit until we do.

If the knowledge that our surplus vessels will cost us tremendous sums of money unless we find cargoes for them, together with the growing realization of the necessity of an adequate merchant marine both in time of peace and in time of war, is a sufficient incentive to induce us to go after foreign trade in the characteristic American fashion, then these vessels will indeed be a blessing. The opportunities for development and expansion in this country are growing less each year and America cannot take its proper place in the world, if it neglects the opportunity to secure its share of the foreign trade which can only be accomplished through American agencies and an American owned and operated merchant marine.

Joseph W. Powell

A VOTE of thanks is due to Joe Powell, as he is familiarly known in the shipbuilding industry, for the valuable assistance that he has given to the Shipping Board and to the country during the past seven months. We say seven months, because, although he resigned the position of President of the Emergency Fleet Corporation on March 4, he then accepted a final commission to inspect the ex-German passenger ships for the purpose of determining which of these vessels it would pay to recondition. His report on this matter, in view of the dearth of passenger vessels under the American flag, will be read with interest.

It is understood that Mr. Powell was very reluctant to accept a position with the Shipping Board as he was probably well aware of the acrimonious criticism that had been constantly directed against the men holding similar jobs in the past but when Mr. Lasker personally asked him if he would not come down to Washington for a short time and help straighten things out, Mr. Powell could not refuse, and so he agreed to accept the job for three months on condition that his service would be gratuitous.

At the end of three months, he agreed to a like extension and it was probably largely due to this extension that Mr. Lasker was able to place before the sub-committee on appropriations a more complete analysis of the condition and needs of the Shipping Board than that committee had ever received before from any Government department.

Mr. Powell has been a strong advocate of a protected merchant marine. He has always claimed that our shipping was an asset—not a thing to be salvaged—and that without it the United States could not take its proper place among the nations of the world. We feel that the critical period of our merchant marine has passed and that slow and sure development along the lines that Mr. Powell has urged is now in sight.

Keep The Government Out Of Ship Repairing!

ONE of the greatest reasons why the Shipping Bill will be passed by the present Congress is that, by granting the direct and indirect aids that are necessary to influence private capital into embarking on shipping ventures, the Government will be able to sell its ships and thereby put a stop to the monthly losses of several million dollars which have and always will occur under Government management of our shipping.

How then can we reconcile or explain the fact that, while Congress directs the Shipping Board to have the primary object of developing a privately owned and operated merchant marine on the one hand, it at the same time entertains an amendment to the Independent Offices Appropriation Bill directing that no part of the money appropriated in the bill shall be used for the repair or reconditioning of any vessel unless reasonable opportunity has been given to Government navy yards to submit estimates on the work?

Does it not show when such a man as Senator Lodge, who is referred to as the scholar of the Senate, seeks political advantage in such a matter as his recent attempt to secure legislation that would have compelled the Shipping Board to send the *Leviathan* to the Boston navy yard that eternal vigilance and prompt action by both individuals and associations working for the good of the merchant marine are necessary?

If the Government is to engage in repair work, why not the municipality? New York city, for instance, is contemplating the construction of a huge dry dock while the concerns in this port who have spent large sums of money to give the Government and private owners the facilities

they require are operating their plants only about half time. With competition as keen as it is at the present time in the ship repair business, it is obvious that any work of this nature allotted to public institutions on an estimate that is lower than the bids of private concerns will cause deficits that the taxpayer will be called upon to make good. If sectional politics is strong enough to defeat the will of the people as expressed in the Jones Act to get the Government out of the shipping business, then it is high time that the public should be informed of the matter so that they may again express their opinion on this subject at the next election.

Financing Foreign Trade

THE outstanding unsolved problem today is the financing of foreign trade. The Shipping Bill if enacted into law will enable American ships to compete with foreign vessels for available cargoes and it will also create a strong inducement for the exporter and importer to ship their goods in American bottoms. It will not, however, solve the question of how European countries are going to pay us for our exports. We do not want any more gold, for every ounce of it that we take weakens the exchange ratios and delays, so much longer, the time that foreign currencies may be reestablished on a gold basis. Our immigration law has reduced the inflow of foreign labor to a minimum that would sell its services and return the major portion of the money it earns to its home country. Our own unemployment problem makes this restriction a necessity although we are not unmindful of the debt that we owe to immigrant labor for the aid that it has given us in developing our vast industries. Nor can we permit the unrestricted dumping of foreign products that would close our factories and deprive our own labor of employment.

There remains, then, the importation of such goods or raw materials as are not obtainable in this country, the importation of such things as we do not raise or produce in sufficient quantity for our consumption and the importation of goods for re-export. However, it is not probable that these three factors could be developed sufficiently in time without liberal extensions of foreign credit to relieve underproduction here or abroad.

Although Europe financed us until we were able to stand upon our own feet, it is not so much a question of returning the obligation as it is a question of preventing a lowering of our standard of living. We have got to the point where we must either curtail production or export our surplus. We can export this surplus in ever increasing quantities and in direct ratio to the improvement of the standards in other countries. Unfortunately other Oriental countries are not as progressive as Japan, who has bought enormous quantities of goods in the world markets during the last fifty years, or our problems and Europe's problems of a surplus market would be quickly solved.

Much of the world remains undeveloped but it will not remain so. If Europe is aided in getting on her feet so that she can take her place in the march of progress, there will be no question of her ability to repay her debts but otherwise she will remain a constant menace to the whole world. The ninth National Foreign Trade Convention will meet in Philadelphia May 10, 11 and 12, when the ablest business minds of the country will concentrate on these problems. Let us hope that they will find a way to put our idle manufacturing plants, our idle ships and our unemployed to work.

Situations Wanted

ONE of the most distressing results of the present shipbuilding depression is the number of competent men skilled in all branches of this industry who are unable to find work. Not a week passes that we do not receive requests from men, many of whom we know possess more than the average ability in their particular line, to find them some opening for occupation in the business to which their lives have been devoted.

We know of no better way to assist these men in placing their qualifications before the eyes of the shipbuilding executives than through the *Positions Wanted* columns of our magazine. Marine Engineering and Shipping Age has made a special rate of 5 cents a word for such advertisements (minimum charge $1 for each insertion). This rate is far below that charged for other advertising and we have made it so in order that the man out of work can send over 5,000 messages and cover the entire shipbuilding field for the price of a luncheon.

The Hague Rules

THE National Foreign Trade Council has issued an appeal to the ocean carriers to put the Hague Rules into effect. The International Chamber of Commerce through its executive committee has approved the Hague Rules and directed that immediate steps be taken by its officers to secure the acceptance of these rules in the more than 20 countries holding membership in the International Chamber.

Although at least 20 of the most prominent British steamship lines operating between Great Britain, the United States and Canada have developed the provisions of these rules in their bills of lading for westbound traffic, they are precluded from doing this on the eastbound traffic by certain provisions of the Harter Act, which is the controlling legislation on this matter in the United States.

The Shipping Board has indicated to the Interstate Commerce Commission in connection with the consideration that that body has been giving to a through export bill of lading, that it intends to promulgate a port bill of lading in the near future, and the board has expressed the opinion that there should be no variance in essential particulars between the two bills.

As Section 19 of the Jones Act authorizes the board to only make rules and regulations affecting shipping in the foreign trade that are not in conflict with existing law, it would appear that Congress will have to pass enabling legislation which will meet the situation quicker than would a general revision of the Harter Act. It is essential and for the general interest of the country to secure as early a determination on these matters as is possible.

Now For Action!

By "Old Scotch"

President Harding has very tersely expressed the opinion that all patriotic citizens, regardless of political affiliations, should have one end in view, and that is the development of an adequate American merchant marine. Congress now has before it the Government's plan for accomplishing this end. This plan has been endorsed by practically all leading shippers, shipowners and shipbuilders. It is up to you, Mr. Reader, to tell your Congressman to give it his unqualified support.

THE President has at last spoken the long expected endorsement of the principle of Government aid to our merchant marine. He has courageously carried out his pre-election promises to leave no stone unturned to provide for our permanency on the seas.

Rumors of opposition in his own party, of the probable antagonism of the so-called "agricultural bloc," of the opening evidences of inspired propaganda from foreign sources, have not deterred him an iota from his firm resolve. He had all phases of the intricate problem of American shipping thoroughly investigated by competent committees under the auspices of the Shipping Board, and, after carefully weighing in his own mind the various pros and cons of the problem presented, he has delivered to Congress a message based on sound and logical principles and facts.

The message and supporting evidence have been thoroughly considered, and, to those who propose to combat the array of facts presented, the gratuitous advice is given to watch their steps. No proposed legislation of similar import has ever before been given the careful, scrutinizing and painstaking thought which has attended the formation of the measure now pending before Congress.

Well Begun Is Half Done

The old saying that "Well begun is half done" should apply with full force to this measure. All possible points of attack have been carefully guarded against, but none of us must forget that the unexpected very often happens, and it is the other half of the completion of the enactment of this proposed law to which all of us who are interested in the American merchant marine, must bend every effort.

Opposition is bound to arise and, in fact, is already in evidence. It behooves every one interested, and I take it that 99 percent of the readers of this magazine belong to this category, should bend every effort to lend aid to this meritorious bill. If false representations of the intent and purpose of the bill crop out in the daily papers, or in your daily conversations with people ignorant of shipping, leave no stone unturned to correct the wrong impressions which may start in those ways. Write your Congressman and Senators of your interest in the measure and give them supporting evidence of the benefit it will be to their own districts and to the country at large. The time is now here when every proponent of American shipping must show his hand and lend every assistance possible.

This is the last call, and if it fails, your jobs in shipyards, on board ships, or in the various ramifications of business connected with our shipping, will fail also. If you are out of a job now, and unfortunately many people connected with shipping are in that unfortunate predicament at this moment, here is the last chance to start up business again and get back into harness.

Most people go into the shipbuilding or ship operating game because they love it. If you are anxious to get back with your first love, you must do all you can individually and collectively to push this bill across. It will be over one way or the other in the next four months, as our Congressmen come up for re-election next fall, and in election years they don't like to linger around Washington much after July 1, as they have many fences which need mending around home from that time up till the first Tuesday in November.

Let Your Congressman Know Where You Stand

If you are out of a job now, tell your Congressman that if he can see his way clear to vote for this subsidy bill it will probably give you a chance to get another job, and, incidentally, when he is hunting around for support to retain his job in Washington, you might see your way clear to give him a boost on election day. The essence of practical politics is based on the old principle of "One good turn deserves another," so, if you want a Congressman to help you out when you are in trouble, don't forget to return the compliment when he is struggling to retain his job.

Knowing many of those gentlemen very well, I can vouch for the fact that there are no more appreciative men anywhere than the average Congressman. If you are interested in a pending measure and you write your representative telling him that you are, and the reasons why you are, he will hesitate a long while before turning you down. If you can convince him that he should vote for a certain bill, and he does vote for it, and you should write him a letter of thanks, it would be a case, as certain cartoonists describe it, of "Oh! Boy, how he do appreciate it."

It is so usual for the average citizen to condemn and speak evil of their representatives in Congress and other legislative assemblies, that a little praise and expression of appreciation now and then goes a long ways towards encouraging our chosen spokesmen on public questions. From the writer's many years of acquaintance with public men, he has drawn the conclusion that the great majority of them are honest and anxious to do the right thing. On subjects with which they are not familiar they are regular corkscrews for drawing out facts, and generally when good honest information is presented to them they vote the right way.

In the matter of this subsidy bill, we have all the facts and arguments on our side; and it is up to all of us to see that they are sown in the right field, which now is at the Capital in Washington.

If they want a good example of the benefit of a merchant marine, tell them the following incident, which fairly well illustrates the point.

One of the Many Benefits of a Merchant Marine

The good ship *George Washington*, by virtue of the recent scrap with the Kaiser, now belongs to the United States and flies the stars and stripes. A few weeks ago she started from New York with a party of American citizens on board, numbering about 650. We Americans, you know, love to travel around and visit sights about which we have read since childhood. Hence when it was advertised around the country that this American vessel would make a trip of ten

weeks' duration, during the inclement winter and spring months, up the Mediterranean, visiting the Holy Lands, Egypt and other historical places, many of our citizens dug down into their saving accounts and "coughed up" an average of $1,650 each for the pleasurable experience. One enthusiast, it is stated, paid $16,000 for the privilege of sojourning in the so-called Presidential suite during the ten weeks' tour. Another, less wealthy, is said to have made an offer for the privilege of sleeping in the barber's chair during that period, when he was informed that all staterooms had been sold. A very easy calculation will show that over one million dollars were paid for this single trip, of which, it is estimated, there will accrue a clear profit of probably $100,000 to the Shipping Board.

Of course, it is not intended to convey the impression that all trips made by Shipping Board vessels are relatively as profitable. Far from it, sad to state! The great underlying principle of this illustrative trip is that the million dollars taken from our people's savings is kept at home, and spent mostly within our own borders. The officers and crew are American citizens and support families living in our midst; the vast quantities of food purchased were bought from our own farmers and merchants; our repair yards will benefit from the necessary voyage repairs after the vessel returns; the various electrical, deck and engine room supplies were purchased from American dealers, who, before, had purchased them from manufactories scattered all over our own land. Many similar excursions have sailed forth from our home ports to foreign lands, patronized exclusively by American citizens, but can you recollect of any such making the trip under the American flag before? I cannot.

What the Subsidy Bill Will Do

Suppose, for example, that there should not be any profit for a private shipowner for a trip similar to this, which is altogether probable, as this represents exceptionally favorable circumstances, as such a trip can only be made about once a year. In other words, a private shipowner might break about even on receipts and expenditures, and hence would not be warranted in undertaking the enterprise. The proposed subsidy bill, if passed, would return him approximately $25,000 based on speed, tonnage and distance traveled, or just about enough to turn the balance from failure to success. Will it not be a good investment for the Government by the paying of that small sum to keep the expenditure of over a million dollars in our own borders?

Why our dear old Uncle Sam would collect almost that amount in the various taxes he levies on the people interested in the expedition. In addition to that, he will have a ship of inestimable value to him in time of war, maintained in peace times at private expense. As a by-product, we must give credit to a large amount of self-satisfaction and innate pride on the part of American tourists in that they can visit foreign parts on vessels owned, manned and operated by our own people.

The principle of expending a small direct sum of money or of granting direct exemptions in taxes, etc., in order to secure the expenditure of much larger amounts in certain communities, is one that is well recognized and adopted throughout our land. Just call to mind while passing through many American towns, on the railroads, the numbers of signs you see to the effect that "Free Factory Sites" are offered to any one who will establish a business in that particular town or city. Some offer exemption from taxes for a long term of years and various other inducements.

It is estimated that we spent over $500,000,000 for ocean transportation last year when business on the seas was very, very dull. We certainly are entitled to retain at least half that amount within our own borders, but we did not by any means. If we can expend directly the maximum amount of the subsidy recommended by the President, of only $32,000,000, and guarantee thereby the retention of at least $250,000,000 to spend among our own citizens, is it not from this standpoint alone a most excellent investment?

I have attempted in this series of articles to bring out the most salient points of advantage to be derived from having our own merchant marine, and I must admit that the surface only has been scratched.

President Harding has very tersely expressed the idea that all patriotic citizens, regardless of political affiliations, have one end in view and that is the permanency of an adequate American merchant marine. He also suggests that, if any one does not agree with the recommendations he has made to accomplish the object, it is up to the critic to suggest better methods of accomplishment.

I think we can all agree with the executive on that point. We, in this instance, are all from Missouri and would like to be shown the better methods, if there are any.

Geared Turbine Steamer Gouverneur General Chanzy, Built by Messrs. Cammell Laird, of Birkenhead, for the Marine Merchande, for Service Between Marseilles and Algiers. The Vessel Maintained a Speed of 19.559 Knots on Her Four-Hour Full-Power Trial

The Merchant Marine Bill of 1922 Analyzed

One of the Experts Who Assisted the Shipping Board in Framing the Bill Outlines Its Merits

By Winthrop L. Marvin*

IN form the bill "to amend and supplement the Merchant Marine Act, 1920, and for other purposes" (the new shipping bill, to be known as the Merchant Marine Act of 1922) brings varying emotions to those who study it. Maritime Europe is aghast; its "listening stations" in this country failed to predict the blow that was coming. The new bill reaches further and hits harder than our competitors by sea had imagined, but it does this without fracturing treaties or unduly provoking retaliation in kind. Suppose Great Britain, Germany and Italy reserve their emigration, as we propose to do our immigration, 50 percent to National vessels—what harm can come of that? It would be an entirely fair and reasonable arrangement all around.

Ship Sales

In the first place, it is significant that the new bill skilfully amends the ship sales section of the Jones Act of 1920 so that the Shipping Board will be freed of all restrictions as to cost of reproduction, etc., and it is directly authorized to dispose of the government-owned fleet at world-market prices. This will presumably have the support of most of the majority party in Congress, and the Democratic minority is faced with the ugly historical fact that in past years, urging a free ship policy or free purchase of vessels from abroad, it has contended that Americans should have a chance to buy their ships for foreign trade "on even terms with their competitors!" It must be remembered that the free ship provision of the Panama Canal Act of 1912 remains in force, and that American shipowners have a lawful right to buy foreign trade ships abroad, though these imported vessels, except in special cases, will not be eligible for subsidy. If any Democrats object to a "sacrifice" sale of government ships all the Republicans will have to do is to turn their own arguments against them.

Construction Loan Fund

A second important amendment of the Jones Act is provided in the new bill by the specific naming of the sum of $125,000,000 as a construction loan fund which may be availed of either for the building of vessels "of the best and most efficient type, equipped with the most modern, the most efficient and the most economical machinery and commercial appliances," or "in the equipment of vessels already built with machinery and commercial appliances of the type and kind mentioned." Under this provision it is anticipated that powerful aid will be given to the construction of fast liners in which we are so notably deficient, and to the construction or equipment of motorships. This is a fair interpretation of the purpose in the minds of the authors of the present measure. Very liberal are the limitations that "no loan shall be for a greater sum than two-thirds of the cost of the vessel to be constructed or of the value of the vessel when thus re-equipped, nor shall any loan be made at a rate of interest less than 2 percent per annum."

It is to be remembered that when the British government in 1903 loaned to the Cunard Company $13,000,000 to build the *Mauretania* and *Lusitania*, the rate of interest was 2¾ percent.

Another liberalizing amendment of undeniable value to shipowners is the change made in Section 23 of the Act of 1920, providing that for ten years for the purpose of ascertaining net income subject to the war profits and excess profits taxes of the Act of 1918, or any and all taxes on income of the Act of 1921 or any subsequent Act, the deduction of an amount equivalent to the net earnings of vessels in the foreign trade. It is stipulated that the amount of such deduction shall be pledged to the building of new ships in the United States, one-half of the cost of such ships to be paid for out of the ordinary funds or capital of the owner. The Jones Act required that two-thirds should be of new capital. A similar deduction is provided for owners that may sell vessels built prior to January 1, 1914, under Title I, II and III of the Revenue Act of 1921—this again on condition of new construction in American yards. Thus these features of the Jones Act are made distinctly more valuable.

Deduction for Shippers Using American Vessels

A wholly new feature of American maritime law is that provided for in Section 301 of the new shipping bill for a deduction from the amount which would otherwise constitute the income tax of a sum equivalent to 5 percent of ocean freight money paid for transportation of merchandise in American ships in the foreign trade. This is an ingenious new departure intended to serve the purpose of a part of the preferential duty of the original Jones Act—but, as a matter of fact, it is far more valuable and effective, for it would apply to all merchandise, dutiable or free, inward or outward.

This is treaty-proof. It is not a subsidy, but an indirect aid. Its potential importance is incalculable. It will appeal to all shippers small and large, and will have the effect of making all American vessels first-preferred bottoms. This is one thing which our foreign competitors have been sharply worrying about. They had not expected this new scheme and do not even yet know how to take it. It would apply to the benefit of the entire American merchant marine engaged in foreign trade—"tramps" as well as liners, in proportion to the freight moneys received, which, per actual cost of ship, are far greater in "tramps" than in liners. This may be regarded, therefore, as distinctively encouragement to the slower cargo ships and as a material addition to their modest subsidy.

Of great though not easily appraised value also is the provision of Section 302 allowing more equitable allowance for the extraordinary depreciation in vessel property since January 1, 1921. In Section 303 tonnage taxes on all ships, American and foreign, are doubled, but the revenue goes to the merchant marine fund for the benefit of American shipping.

Assures 50 Percent of Immigration for American Ships

It is to be assumed that the language of Section 401, the purpose of which is to reserve at least 50 percent of immigration to vessels of the United States, has been carefully studied by its authors. The language is technical, but the ways and means of enforcing this proposal must be somewhat complex. Fifty percent of the immigration year after year will go far to make at least 50 percent of the transatlantic passenger liners American, for the overwhelming American majority of cabin passengers will naturally seek

*Vice-president and general manager of the American Steamship Owners' Association, New York.

American ships as soon as an adequate service is created. This is a bar to any growth beyond a certain point of the former huge German steamship concerns, and is apparently a barrier to any further growth on the part of the Cunard Line and its auxiliaries. But the provision is, after all, fundamentally a right one. The United States must have a sufficient naval reserve to maintain its naval standing under the limitation of naval armament. The greatest of these naval reserve steamers are to be sought on the transatlantic routes.

Provides for Naval Reserve

Moreover, these naval reserve ships must be fitly officered and manned in an emergency. This gives a vital value to Section 501 of the new bill, with its assurance of a merchant marine and naval reserve of picked officers and seamen of our merchant service who, after the British example, will receive retainers from the Government. Great Britain before the war had more than 30,000 enrolled in her merchant reserve. We must have an equal number, for we will have equal need. Of course the foreign agitators of the "International" Seamen's Union will fight it—but the time is not now when these gentry can hope to veto the possession of a naval reserve by the United States. President Harding on his own initiative decided months ago to turn the army and navy transport service over to the American merchant marine. Section 601 of the new bill arms him with power to do this of which he is already possessed. However, this is an essential part of any constructive National maritime policy, regardless of other provisions.

The Subsidy

Under the accurate heading "Compensation" rather than "Subsidy," Section 701 provides for carefully graduated mileage payments to "every sail or power-driven vessel of 1,500 gross tons or more, documented under the laws of the United States and operated in foreign trade." Inclusion of good sail craft is justified, for they are performing a useful service, though their numbers will not further increase. A basic rate of compensation is one-half of one cent for each gross ton for each 100 nautical miles traveled—this applying to all ships capable of a speed on light draft up to 13 knots—that is to say, this covers the great bulk or almost all of the cargo-carrying ocean tonnage of the United States. At 13 knots the increase for speed begins with a rate of two-tenths of one cent for each gross ton per 100 miles traveled—and so on step by step up to a rate of two and six-tenths cents for great liners driving at a speed of 23 knots or over.

This compensation, payable on both outward and homeward voyages, is a higher amount than has been hitherto proposed for liners, but, on the other hand, these ships must carry the mails without pay. Under the circumstances, therefore, this compensation, save for exceptionally large, high-speed ships, can be regarded as only moderate.

It may even fall short in the case of some indispensable services, as to South America and the Orient, for example. But in such cases a further provision of the bill in the final paragraph of Section 702 authorizes the Shipping Board to increase the compensation as may be necessary to secure the maintenance of indispensable services, the increased compensation, however, not to exceed twice the regular rate. Moreover, the Shipping Board is authorized to reduce any compensation found excessive.

These elastic features of the compensation portion of the bill, together with the limitation on profits in one of the paragraphs of Section 703, are unique in American shipping legislation. A State-aided ship may not realize a net operating profit of more than 10 percent. This is a legislative experiment that may prove unwise in its result, though it will undoubtedly facilitate the passage of the bill by Congress. Mid-Western Senators and Representatives are frankly recognizing this new bill as "something different," and as satisfying their scruples against excessive subsidies. However reluctant the seacoast States may be to recognize this statutory limitation, it may perhaps prove to be the winning of the law.

The Merchant Marine Fund

Into the merchant marine fund must go 10 percent of the customs receipts, and the increased tonnage taxes, together about $34,000,000 annually—and also the compensation which under the 10 percent limitation may have to be paid back. A very important clause is Section 702 authorizing the Shipping Board to conclude a ten-year contract with shipowners, on behalf of the United States. Therefore, the bill, if once enacted, cannot be easily set aside.

Under one of the provisions of Section 701 oil tank carriers and like craft owned by great producing companies are required to hold open until ten days before sailing "substantially one-third" of their cargo capacity for use as a common carrier, in order to be eligible to the compensation provided. Here again is a provision manifestly inserted to smooth the passage of the bill to meet objections certain to be raised by a certain class of lawmakers. This is another novel feature of the bill which cannot easily be analyzed until it is actually working in practice. It is good expert opinion, however, that the tank and other ships need not be embarrassed, if the provision is enforced in a reasonable spirit.

Philippine trade receives exceptional favors in the bill, anticipating the application of the coastwise laws as ordered in the Act of 1920. The new bill nevertheless stipulates that "trade between the United States and the Philippine Islands * * * shall be considered foreign trade, whether covered by the coastwise laws or not." This would permit the granting of the compensation of the new bill to American ships in the Philippine trade, though their trade was technically coastwise. It is manifestly the purpose of the Administration to make sure that our Philippine commerce is guaranteed most favorable treatment, because of the distance that lies between the islands and the American mainland. Under the shelter of the coastwise law, and with subsidies besides, there can be no shadow of a doubt that our Philippine carrying trade will henceforth be notably efficient and prosperous.

Altogether the proposed Merchant Marine Act of 1922 does more for the American merchant marine than any like measure ever contemplated. Defects of detail it may have—these can be corrected. But the bill itself, if enacted in substance, will prove a Magna Charta of the ocean shipping trade of the United States.

The indirect aids of the bill are very powerful, but by themselves they are not sufficient. The direct compensation to liners and to cargo craft is absolutely indispensable to the complete success of this significant measure. Without that compensation the competition of low-wage and often subsidized and bountied foreign flag ships cannot be successfully met. Congress must accept the bill as a whole, in order to deal justly and effectively with the long-disputed but still unsolved problem of American shipping in the overseas trade.

Shipping Board Dry Docks for Sale.—Announcement is made that the contracts with pioneer purchasers of Shipping Board dry docks have been canceled. Contracts, or the docks themselves, will soon be advertised for sale to the original holders of the contracts. These docks cost an average of $900,000 each, but will not bring more than $350,000 today, it was estimated. All are 10,000-ton docks on the Atlantic and Gulf coasts, some of them being at Baltimore, Norfolk, New Orleans, New York, Perth Amboy, Mobile, Galveston, Jacksonville and Weehawken.

Early Hearings on Shipping Bill Promised

Democrats Urged to Be Non-Partisan—Independent Offices' Appropriation Bill Reported to House—Shipping Board Reduces Expenses

By Harold F. Lane

LEGISLATIVE consideration of the administration's plan for extending direct and indirect aids to American shipping is about to begin in earnest. Hearings on the merchant marine bill before the Senate Committee on Commerce and the House Committee on Merchant Marine and Fisheries, sitting jointly, are expected to begin before this issue of MARINE ENGINEERING AND SHIPPING AGE reaches its readers. Commissioners of the Shipping Board, who have unanimously approved the plan recommended in the President's message of February 28, are to appear as witnesses, as will many of the members of the committee of experts who assisted the board in its preliminary study on which the plan was based. Representatives of the shipping and other industries also are to be heard.

It is announced that the hearings will begin on March 28. It is the hope of members of the committee that they can be concluded in about three weeks' time although adjournments from time to time may spread them over a longer period. It is expected that Chairman Lasker will be the first witness. Copies of the bill have been submitted to the chairmen of other committees who have jurisdiction over some of the various subjects included in the bill, such as the ways and means committee, committee on naval affairs, the immigration committee and the committee on interstate and foreign commerce.

The Democratic members of the Shipping Board, George E. Chamberlain, Frederick I. Thompson and W. S. Benson, on March 6 addressed a letter to the members of the two committees, emphasizing the fact that the recommendations of the board to the President were based upon an intimate study made by the board, without political considerations, and urging the Democratic Congressmen to treat the subject in a non-partisan manner, withholding judgment until after full hearing. The letter said that the members of the board were governed solely by the real questions involved, as follows:

"1. The necessity for maintaining a merchant marine, developed from the immense fleet called into existence by the emergencies of war.

"2. The necessary action to be taken to assure to the United States its former position and prestige on the high seas.

"Aside from the economic necessity for the establishment of an adequate merchant marine under the American flag, deep consideration was given to that aspect embodied in the merchant marine act, 1920, providing for the merchant fleet to be a naval auxiliary in time of war. It is our opinion there can be no divergence of opinion as to the necessity for the full establishment of an American merchant marine; the only question upon which there could be divergence of opinion is whether aid, either direct or indirect, or both, should be granted to accomplish that purpose. It is our opinion that the establishment of an American merchant marine will be impossible without such aid as will equalize present differentials that exist in favor of foreign shipping, and our recommendation to the President contemplated direct aid only in the event the indirect aids first suggested were inadequate to properly develop and maintain an American merchant marine, the direct aid itself being nonexistent if the indirect aid sufficed, and further limited as to profit to the ship only up to an adequate return to the operator on his investment. This assures no profiteering and brings into being direct aid only when it becomes a final essential to maintain American-flag ships on the high seas.

"We understand that there will be a joint hearing of the appropriate Senate and House committees on the bill in question, and we trust you will not deem it impertinent in us, the Democratic members of the United States Shipping Board, to suggest to you and the other Democratic members of the committees of the Senate and House to withhold a final judgment with respect to this legislation until after the hearings have been completed and full opportunity given to the members of the board to state the reasons guiding their action in unanimously recommending direct and indirect aid to American shipping, and so that the full details of the proposal submitted, which has taken many weeks of survey and consideration, shall have been placed, in all detail, clearly before you."

The joint legislative conference of the American Federation of Labor went on record at a meeting in Washington on March 10 as opposed in principle to the provisions of the administration bill and in particular to the sections providing for a merchant marine naval reserve and dealing with the question of immigration, which the committee viewed as nullifying provisions of the seamen's act.

Appropriation Bill Reported to House

The independent offices appropriation bill, carrying the appropriation for the Shipping Board and the Emergency Fleet Corporation, was reported to the House on March 15 and after considerable discussion the House voted to insist on its disagreement with the amendments inserted in the bill in the Senate regarding the continued use of the $55,000,000 and as to the number of salaries in excess of $11,000. During the course of the debate, Representative Byrns of Tennessee stated that Homer L. Ferguson, president of the Newport News Shipbuilding & Dry Dock Company, has a position at a salary of $11,000 a year as a member of the claims commission of the Shipping Board, while his company has received a large contract from the board. A statement was later issued by the board stating that Mr. Ferguson was selected by the President to serve as a member of the claims commission without salary, but that he has at no time sat with the commission and has taken no part in its work on account of his connection with the Newport News company, which company has claims against the Emergency Fleet Corporation, until all the claims in which his company may be interested have been finally concluded.

The conferees submitted a report on March 9 which showed that they had not yet reached a complete agreement on the conflicting provisions of the House and Senate bills, and were given instructions to continue the conference. They had agreed to insert the language proposed by the Senate, providing that no part of the moneys appropriated or made available shall be used for the repair or reconditioning of any vessel until a reasonable opportunity has been given to the available Government navy yards to estimate upon the cost of such work, modified so as to permit the Government arsenals to bid on such work, and further modified so as to require estimates from the navy yards or arsenals when the expenses of such repair or reconditioning is in excess of $100,000, instead of

$5,000, as proposed by the Senate. They had also agreed to strike out, as proposed by the Senate, the provision that no part of the sums appropriated shall be used to pay a greater sum than 5 percent as commissions for the placing of advertising matter contracted for; and the matter, inserted by the Senate, modifying the limitation placed by the House upon the appropriation for the payment of claims by the Shipping Board or Emergency Fleet Corporation; also, as proposed by the Senate, the prohibition of the use of Shipping Board or Fleet Corporation funds for the printing of "bulletins."

Shipping Board Reduces Expenses

On the eve of his retirement from active service as president of the Emergency Fleet Corporation on March 4, Joseph W. Powell issued a statement announcing that the Shipping Board had liquidated $20,373,000 of its assets and had reduced its personnel by 3,302, saving $5,290,000 on payrolls, including $1,324,000 on caretakers. Its operating costs have been reduced by $900,000 a month and the insurance, repair, voyage and lay-up costs as well as general administrative expenses have also been reduced in the last six months.

Detailing the progress made in liquidation since his assumption of office last August, Mr. Powell said that on laid-up ships, which had increased from 950 to 1,278, a saving of $1,324,000 had been made; ships had been sold for $5,000,000, houses for $6,073,000, surplus materials for $5,000,000, and securities and mortgages for $4,300,000, a total of over $20,000,000.

Voyage expenses were reduced from $1,896,000 in July, 1921, to $934,000 in January, 1922. Repairs and betterments, costing $1,467,000 last July, cost only $950,000 in January, even though 30 ships were broken out and repaired for the Russian grain. Insurance on ships, Mr. Powell said, had dropped from $578,000 in July to $416,000 in January, while expenses for lay-up fell off $139,000 during the six months. Administrative expenditures during the past month had dropped from $906,000 to $678,000, he said. Total expenses in December were $4,137,000 and for January were $3,445,000.

For February it had been reported that, whereas the Shipping Board paid its operators $6,400,000, a return of $6,500,000 had been received indicating a cash income of over $100,000 for the month, whereas a deficit has been the case heretofore.

Newspaper publication of this statement, however, made it necessary for Mr. Powell to explain, in a letter to Representative Wood of the House appropriations committee, that the statement did not mean that the Fleet Corporation was making a profit and had no relation to the operating showing for the month, but merely referred to the manner in which it was husbanding its cash and keeping careful check on the outlays by operators.

Mr. Powell's Explanation

"As a matter of fact, as both Mr. Lasker and I repeatedly testified before your Appropriations Subcommittee," Mr. Powell said, "the Shipping Board is losing between $3,000,000 and $4,000,000 per month. Regardless of bettering conditions which now exist in freights, the loss of the Shipping Board for some time to come will continue constant at the approximate $4,000,000 figure, because vast sums are being paid out at the present time for insurance due from the past, of which we knew nothing until within the last two weeks. Yesterday Mr. Lasker paid out $2,000,000 for P. & I. insurance due from prior periods to the present board's incumbency, of which no record existed and of which no knowledge came to the board until two weeks ago. Also, during the period between August and January, when freights were scarce and rates soft, very little work was done on the tied-up fleet, because Mr. Lasker desired to husband the cash resources of the Shipping Board so as to come within the limitations of appropriations. It is for that reason that the expenditures on the tied-up fleet, referred to in the article attached, were so low, operating as we were a lesser number of ships than we had been, and having taken out at first the best ships.

"From now on there will be comparatively large expense in repairs in further ships we take out of tie-up and in putting necessary reconditioning into some of the tied-up ships. All this was deferred during the period when voyage losses were so great; but, now that conditions are better and voyage losses will be lessened, repairs to the tied-up fleet can no longer be deferred. For this reason the loss will be constant at around $4,000,000 a month, as testified to by Mr. Lasker and myself. In other words, during those periods when voyage losses are great, we cannot do necessary repairs to the tied-up fleet. Whenever we get relief from voyage losses, the tied-up fleet is repaired. So that according to this policy of Mr. Lasker's, the Fleet Corporation will keep within appropriations, keep trade routes going, and keep its tied-up fleet in condition.

"Permit me further to call to your attention that while it is true, as the article states, that we have liquidated some $20,000,000 worth of assets since the new board came into office, only $7,045,490 has been collected on same, of which $1,500,000 came in last week. The balance of the moneys on liquidated items are due, either in part before July first next or extend over long periods. A careful estimate made yesterday, which was submitted to me last night, would indicate that the amount that we can surely count upon to be realized in cash from liquidation between now and July first will be approximately $25,000,000, as stated in our testimony before your committee. There is a vast difference between cash received from liquidation before July first and amount of goods liquidated, which are sold for part cash and part on long time."

Mr. Powell, in resigning his office, in which he was serving without salary, agreed to undertake one commission for the board, a survey of the 30 former German ships, most of which are docked at Philadelphia, to determine which appear advisable for the board to recondition with a view to offering them for sale.

Commission Modifies Export Bill of Lading

The Interstate Commerce Commission has issued an order modifying in certain particulars conditions in its export bill of lading upon recommendations made by the United States Shipping Board, after a hearing at which the board was represented by counsel and Vice-President W. J. Love of the Emergency Fleet Corporation. The board has approved the bill of lading as thus amended and agrees that it should not be put into effect until July 15. The board also approved the bill of lading prescribed by the former order of the commission, to be used until that date.

The Interstate Commerce Commission has also issued an order in accordance with Section 441 of the Transportation Act designating points on railroads at which information relative to the handling of export shipments by common carriers by water in foreign commerce shall be maintained and at which through bills of lading to foreign destinations in connection with ocean carriers, whose vessels are registered under the laws of the United States to points in non-adjacent foreign countries, shall be issued.

Increased Cargo Offerings.—J. Barstow Smull, vice-president of the Emergency Fleet Corporation, is receiving many inquiries from M. O. 4 operators at Gulf and Atlantic ports for more ships, showing an increase in cargo offerings. It is the policy of the Shipping Board not to furnish ships, however, unless the operators can demonstrate that they will be able to show a profit or at least earn expenses.

Shipping and Shipbuilding in Great Britain

England Sees Danger in Portugal's Example of Flag Discrimination—Abolition of Income Tax for Shipping Advocated

By W. H. Wendon

THE most widely discussed subject in shipping circles at the present time is in regard to what at first blush is a question of minor importance. I refer to the Portuguese Government's decree which imposes in several different ways a most severe handicap on the ships of foreign nations calling at Portuguese ports. The comparative unimportance of the trade of any country with Portugal would, of course, be sufficient in ordinary circumstances to render the decree beneath the notice of the major maritime nations. But the shipping community in this country is fearful that the bad example which Portugal has thought fit to set is fraught with serious consequences. Indeed, if the project is not nipped in the bud, it is regarded as inevitable that other nations will follow suit and that the principal maritime countries of the world will be at each other's throats on the question of flag discrimination.

Sir Kenneth Anderson, the head of the Orient Line, to quote only one shipping authority, maintains that it is imperative that British shipowners should, with all possible emphasis register their protest at the action of Portugal and reaffirm the conviction of owners here that, not only in the interests of British shipowners but in the interests of all shipowners and in the interests of the whole world-wide community, irrespective of nationality, trade or profession, such a policy must prove ultimately injurious.

Discrimination an Obstacle to Exchange

The effects of discrimination are obviously manifold. It is an obstacle to exchange and automatically increases the cost and the scarcity of commodities and services. In short, as Sir Kenneth Anderson stated recently at the annual conference of the Chamber of Shipping of the United Kingdom, discrimination invites the world to a game of "Beggar my neighbor," in which all must lose and none can gain. A disturbing feature of Portugal's action is the belief that she has been inspired to adopt her new policy at the direct or indirect persuasion of Germany.

A representative body of shipowners in London has unanimously resolved to urge the British Government to direct the attention of foreign governments who have recently adopted or threatened measures of flag discrimination to the prejudicial reaction of such measures on the trade of the world and to the unreasonableness of expecting a continuance of the free navigation and equal trading rights hitherto accorded by the British Empire in the face of measures hurtful to its shipping.

Levying of Income Tax on Shipping of Other Countries

Another subject of the greatest importance to shipowners in all countries is the levying of taxation abroad. Shipowners in Great Britain advocate the abolition of international income tax, by which expression is meant each country levying income tax on the shipping of every other country. Each country necessarily differs in its system of taxation, so that a ship proceeding from, say, Antwerp to the River Plate might have seven different countries to placate, seven bundles of forms to fill in, accompanied by seven different penalties.

Then there is the fallacy lying in the assumption that by calling at a port the owner of the ship is making a profit out of that country in which the port is situated. Whereas, in fact, the owner is spending money all the time his boat is in port. Fiscal taxes should, therefore, it is urged, be payable only to the country to which the ship belongs.

America Takes Initial Step

The greatest praise is due to America for having taken the initial step in the abolition of these taxes. In her Revenue Act of 1921, passed in November last, Congress exempted from tax the income of a foreign shipowner, provided an equivalent exemption is granted to the citizens of the United States. British shipowners have pronounced in favor of petitioning the Government to seize the opportunity afforded by America and of putting an end to this international taxation conflict. The slogan of British shipowners is: "The profits of shipping are earned on the high seas and as such are taxable only in the country of domicile."

Port and Harbor Dues

A vigorous campaign is being conducted in Great Britain to secure a substantial reduction in port and harbor dues. The Chamber of Shipping has expressed its views with no uncertain voice and it has the backing of the principal industrial associations in the British Isles. Thus, the Federation of British Industries, a young but decidedly go-ahead body, has communicated its opinions to the port authorities of London, Liverpool, Manchester, Hull and Dundee. It points to the fact that, when a survey is made of the charges prevailing at the different ports and docks, it is found that only one or two of these have charges standing at less than 100 percent above the pre-war level, while, in the great majority of cases, the charges range from 100 to 150 percent above 1914 and in some instances even exceed this figure.

The contention of traders is that the port and harbor charges are not only quite out of relation to the general level of prices prevailing in this country, but that they give no adequate reflection of the direct advantages which have accrued to the dock companies through the fall in the price of the material which they consume. There is, therefore, the grave danger of shipowners being still further handicapped in their efforts to reduce freights to meet the demands of British manufacturers and exporters, and the consequent diversion of traffic from the United Kingdom to Continental ports, where charges are on an appreciably lower scale.

The Federation of British Industries hopes, as a result of its protest, to obtain a reduction in port and harbor charges of at least fifty percent. They will, however, not attain their object without a struggle. The dock and harbor proprietors, for their part, are convinced that their charges are no higher than are justified, Lord Devonport, the chairman of the Port of London Authority, declaring that, if the authorities were to reduce their charges in the manner proposed, they would be heading straight for the bankruptcy court.

"Survival of Fittest" Still Continues in Shipping

In the United Kingdom shipowning world in general, and Cardiff in particular, the survival of the fittest continues. Another late boom single ship concern—the Glynn Shipping Company, of Cardiff—has met with disaster, the mortgagors having exercised their rights by taking possession of the company's 5,200-ton deadweight steamer. The company has

other liabilities to the tune of £27,500, of which £23,000 is due to the tax authorities and £4,000 to bankers. The profits secured during the company's first year's trading ending August 31, 1920, were £33,575, of which £15,000 was reserved for taxation and depreciation, and a dividend of 12½ percent paid. As a result of the second year's working a profit of £18,239 accrued, and a dividend of 2½ percent was distributed. The affairs of this company are typical of so many other concerns formed during the period of inflated ship values.

Reduction in Ship Repair Costs Urged

Shipowners are counselling the urgency of securing a reduction in costs in another direction, namely, ship repairs, which are still costing this country far more than in pre-war days and are appreciably higher than in some Continental countries. Sir Frederick Lewis, the newly-elected president of the Chamber of Shipping, thinks it may safely be said that many vessels are now lying unrepaired because the cost of repairs would exceed the value of the ships when repaired.

Tonnage Laid Up

An estimate of the British tonnage at present laid up in the United Kingdom puts the figure at 2,250,000 tons gross, while the United States Shipping Board (apart from privately owned vessels, wooden and composite vessels) is stated to have some 1,000 ships lying idle, representing possibly something over 4,000,000 tons gross, other maritime countries, of course, being in much the same unfortunate position. Incidentally, there are 30,000 British merchant marine officers and seamen without employment at the present time. Sir Frederick Lewis put the shipping depression question in a nutshell when he confessed that he had no sovereign remedy for it. He recalled that schemes for proportionate laying up of tonnage, for breaking up, or even sinking, old and obsolete tonnage have all been canvassed, but that these schemes, excellent in their way, all start with the idea of cutting down the supply to meet the demand, whereas the aim should be to increase the demand up to and beyond the supply. He considers that the best part shipowners can play is in reducing operating costs to a minimum and raising the efficiency of cargo handling in ports to a maximum.

German Shipyards Busy

An absurdity of the tonnage position is that, despite the huge excess of cargo space in vessels, judged by the present lack of freight offering, coupled with the fact that it costs more to build new vessels—even in Germany—than they can be bought for second-hand, German shipyards are still turning out a large volume of new tonnage, a great deal of the expenditure on material and labor thereby involved being pure waste.

Shipbuilding Faces Labor Crisis

The shipbuilding and engineering industries of Great Britain are in much the same dull position as of late. Indeed, in regard to engineering, something like a crisis prevails on the much-debated question of the rights of trade unions to decide when members of their organizations shall or shall not work overtime. The view of employers is that no trade union should be in a position to interfere with the right of employers to exercise managerial functions in their establishments, while employers for their part shall not interfere with the proper functions of the trade union. The subject has caused serious controversy in the past and it is generally hoped that engineering employers will make a great effort to secure once and for all a definite understanding with the unions on this point.

King George Interested in Navagation Congress

The King has consented to become patron of the Congress to be held in London, under the auspices of the International Association of Navigation Congresses, in 1923. Lord Desborough will be president of the Congress, which will be attended by the leading representatives of dock, harbor, shipping and inland navigation authorities of the chief countries of the world.

Philadelphia Fireboat J. Hampton Moore, Recently Built by the Merchant Shipbuilding Corporation, Chester, Pa.

The vessel is 120 feet 9 inches long over all, 28 feet beam, 12 feet 9 inches depth and on a draft of 9 feet has a speed of 14 miles per hour. Her equipment consists of four turbine fire pumps, one main water tower 30 feet above the main deck and two small towers 15 feet above the main deck. On top of each deck and on top of the pilot house there is a 3000-gallon monitor nozzle designed to operate at a working pressure of 250 pounds. The four pumps are capable of throwing 10,000 gallons of water per minute against a head of 200 pounds.

Developments in Marine Insurance

Rating Shipping Board Vessels—Seaworthiness—Safety Rates—New Lake Carrier Type—Ice-Closed Ports

By "Bordereaux"

CLASSIFYING Shipping Board vessels for purposes of equitable rating is one of the most conspicuous problems now engaging marine underwriting attention. And it has to be confessed that in spite of the experiments constantly made during the last year or more it still remains a problem. To date, neither the insurers nor the insured have been satisfied with the results. This, upon reflection, will be seen to be unremarkable, because the Shipping Board's insurance problem is an extremely delicate one. Friends of the Board believe that Shipping Board vessels should be rated on the same basis as the old experienced liners; but the underwriters can not see it that way, in view of the lack of any extended experience back of the former's boats upon which the underwriters can safely construct conditions and rates closely approximating those regularly given the older lines. Even to approach the preferential or parallel basis desired by the champions of the Shipping Board boats there would have to be devoted to the problem close study by the ablest men in the insurance business in America.

And that is precisely what is going to be done now. A week or two ago Vice-President W. J. Love, of the Shipping Board, met in New York with a number of prominent marine underwriters who handle the bulk of the ocean cargo coverage of this market and consulted with them upon the best means for attaining the end so much desired by both sides of this controversy. The result was the holding of a meeting the following morning at the offices of the American Marine Insurance Syndicates at which practically every leading New York marine underwriter was present. A committee was appointed to grapple with this problem, consisting of the following eminent underwriters: Hendon Chubb, William H. McGee, Louis F. Burke, E. W. S. Morren, W. L. H. Simpson, J. E. Hoffman, F. H. Cauty, G. C. Moore, G. Brenker, C. R. Ebert, Samuel Bird, W. J. Roberts, S. D. McComb, C. A. Orr, D. F. Cox, A. F. Post, Jesse Spier, W. W. Parsons, George C. Owens and Charles R. Page, chairman. This group is representative not only of the leading American companies but of the foremost admitted foreign institutions as well. The committee, in turn, chose William H. McGee, Hendon Chubb and Charles R. Page as its conferees to confer with a similar group to be appointed by the Shipping Board.

The purpose of the appointment of this committee is to investigate carefully and impartially the conditions under which lines operated by the Shipping Board in competition with either American or foreign-owned private lines are operated and to recommend to underwriters generally the adoption of classifications which will tend to sweep away any differentials which may no longer be justified.

It is the general feeling of the underwriting community that Shipping Board vessels when operated in competition with privately-owned vessels are entitled to the utmost consideration at their hands and, whenever and wherever conditions will permit, the underwriters aim to put such vessels on a rating parity with other similar tonnage with which they may be in competition.

As it is well-recognized that the Government-owned vessels can seek only to be placed upon a parity of rating with their privately-owned competitors, it is hoped that as a result of the careful investigation of the facts which is being immediately undertaken, the committee may be able to recommend to underwriters the adoption of a classification basis which will give due recognition to the much improved conditions under which the Government-owned vessels are now operated.

As soon as the committee has been provided by the Shipping Board with the information essential to the prosecution of its investigations the former will proceed through the medium of several smaller committees to a careful investigation of the type and character of the vessels, both privately-owned and Shipping Board owned, engaged in various trades, and also to enquire carefully into the experience of the various managements. Upon the result of these investigations will depend the recommendations of the committee.

Marine Syndicates Annual Meeting

THE annual meeting of the American Marine Insurance Syndicates and of the United States Salvage Association was held on March 9. The fact that this was the first meeting at which the results of a full year could be presented, in view of the brief period in which the Syndicates have been operating, made the occasion one of more than usual interest. Enough was shown to abundantly establish the financial success of these important adjuncts to American hull underwriting. The latest figures, which were as of December 15 last, indicate that Syndicate "B" had at that time a credit of $520,000, and Syndicate "C" a credit of $1,627,000. By "credit" is meant a near approximation to profit; the precise profit can not be definitely given until the full period of the accounts has been run through. What used to be known as Syndicate "A" is now the United States Salvage Association, and this has only been in operation a matter of less than six months. W. W. Parsons, E. C. Jameson, F. H. Cauty and Lawrence J. Brengle were elected as directors of the Salvage Association for the three years ensuing to take the places of those whose terms expired in March. The Atlantic Mutual, Fireman's Fund, Globe and Rutgers, Providence-Washington and Continental were elected for three years as members of the Board of Managers. Reports were rendered by Mr. Brengle, as acting manager and chief underwriter of the Syndicates, and by Hendon Chubb as chairman of the Underwriting Committee.

Writing War Risks Again

DISTURBED conditions in Egypt and India have led British underwriters to give notice under the cancellation clause in open policies that such covers as include war risks must be terminated so that a readjustment of premiums may be effected. This is because the war risk policies include the risk of strikes, riots and civil commotions—hazards that have been coming prominently to the fore in the East of late.

Seaworthiness

A PERSISTENT rumor comes from London to the effect that the underwriters of that market, upon whom fell the $1,200,000 loss sustained in the burning of the *Northern Pacific* during its run from New York

to Chester, Pa., are disposed to resist payment on the ground of unseaworthiness, based upon the report of the insufficiency of the crew. Every marine insurance contract carries the implied warranty of the seaworthiness of the vessel. This warranty means not only that the ship is structurally sound but that she is equipped with fuel, stores and a crew sufficient for the voyage upon which she is to sail. This is a question that has been before the courts time and again, and in each instance the size and capabilities of a vessel's personnel have been decided upon the requirements of the particular voyage.

It is extremely doubtful whether the courts would hold with the text-book writers in making seaworthiness a condition precedent which, if not fulfilled, prevents the attachment of the policy. The argument is frequently made that no such rule should be applied in cases where the vessel was unseaworthy at the time of sailing but unseaworthiness did not contribute to her loss. In the well known case of the *Themistocles,* when an action was brought on the bill of lading against the owner of the vessel, the court held that even though she had sailed with boilers in an unseaworthy condition yet she was lost through stress of weather and not because of the state of her boilers, and the owners were held not liable. Phillips is of opinion that if unseaworthiness is corrected before a loss arises therefrom the insurance is not of necessity voided.

Even though the crew of the *Northern Pacific* was large enough to navigate the vessel it may still be necessary to prove that the crew was sufficient to cope with such a fire as might arise in the course of her voyage.

New Type of Lake Carrier

MUCH interest is felt by marine insurers in the proposed improved type of cargo carrier which is under construction for the handling of mixed cargoes from Great Lake ports through the Barge Canal to New York. It is to have a deadweight capacity of about 4,000 tons, will be 300 feet long, 43 feet wide and 24 feet deep. A steering propeller in the bow will aid the rudder, and the engine equipment will probably be of the Diesel type. It is thought probable that this new type will be employed to compete with the proposed direct service to Atlantic ports via the St. Lawrence River.

Underwriters are also interested in the memorandum filed by the Merchants' Association with House Interstate and Foreign Commission opposing the St. Lawrence Ship Canal. This document stresses the economic character of the present lake carrier as compared with the ocean carrier, which will operate on the lakes as the ship canal becomes a reality. The former is admitted to be the most effective type of vessel in the world for the work it has to do.

Liability in Ice-Closed Ports

MATERIAL differentials are generally made by underwriters for summer and winter sailings to Baltic and other northern ports in order to compensate for the ice hazard. Conditions are improving at this time of the year, so far as this feature is concerned, but who is to say what a belated spring may bring forward in those latitudes? In this connection it is of interest to consider a question that is frequently being put up to underwriters as to the liability of the latter for expenses incurred in transshipping cargoes at intermediate ports in event of the port of destination being closed by ice. These costs are not regarded by the underwriter as properly chargeable to him inasmuch as they are incurred by the shipowner in order to facilitate the turnaround of his vessel, and should be borne by the latter as part of the expense involved in earning his freight. The underwriter certainly continues on the risk until the discharge of the goods, and under the clauses of the policy granting the right to transship, and as respects deviation, he would seem to be liable for loss from an insured peril during transit, if the goods were transshipped at an intermediate port and forwarded to destination by rail. Phillips cites an interesting case of a vessel returning to her port of loading after being unable to enter her port of destination because of ice conditions. According to the decision in this case it appears that, if the master returned with the intention of ultimately completing the voyage when navigation opened, the underwriters would continue until the vessel had finally discharged her cargo at the port of destination. As a matter of fact, if the bill of lading required the owner of the goods to pay the expense of transshipment in such a case as that mentioned at the beginning of this paragraph, the underwriter might be willing to defray the cost in order to get off the risk that much sooner.

Salvage Charges Contested

CERTAIN salvage awards made by the Shipping Board are meeting with protest. A considerable number of underwriters feel that insurance interests are not fairly represented and that the salvage charges of the Shipping Board vessels are excessive and unreasonable. Under the salvage methods now employed by the Shipping Board their vessels are directed to proceed to the scene of an accident and to remain by, and this, it is felt, does not work out with fairness to the cargo interests involved. In event of an underwriter contesting a salvage charge in defense of cargo interests on a Shipping Board vessel, the final decision rests with a body that is not regarded as entirely unbiased because of its close identity with the Board.

Rates for Safety Appliances

WHEN promoters of safety devices for shipboard installation request a preferential in the premium rate for such appliances the underwriters generally reply that rates are predicated upon experience and that no credit can be given in the rate until the invention has proved its worth. This is because it is next to impossible to estimate the value of such inventions as far as the safety of a venture is concerned. It is probable that insurance rates have responded right along to the benefits derived from successful inventions that have increased the safety of voyages, as fast as these devices have shown by experience that they warranted it. Rates for ocean insurance have steadily gone down as shipbuilding has improved, and it has not always been because of the pressure of competition. Underwriting profits vary but slightly over a period of years, and the rates would not have come down had results not warranted it. Thus it is clear that added safeguards, minimizing the risks of the underwriters, have made rate reductions possible. Among such proven safeguards may be mentioned the wireless, the radio, numerous fire-fighting and fire-detecting devices, watertight compartments and similar improvements.

The "Model Bill" Becomes Law

MUCH to the gratification of all interested in seeing the way cleared for American marine underwriters to compete on more equal terms with their foreign competitors, the so-called "Model Bill" for the District of Columbia has passed Congress by a comfortable majority vote in both Senate and House and been signed by the President. The purpose of this legislation, as we have frequently pointed out, is to afford an example, or "model," for imitation in State Legislatures so that the handicaps imposed in the forty-eight political divisions of the country may be removed and American underwriters be given a fighting chance with their business rivals.

National Merchant Marine Association Convenes

President's Message Receives Unqualified Endorsement—Marine Subjects Discussed as a Non-Partisan Issue by Prominent Shipping Authorities

THE annual convention of the National Merchant Marine Association was opened by its president, Senator Joseph E. Ransdell, Friday morning, March 3, in the Rose Room of the Hotel Washington, Washington, D. C. The conventions of this association have come to be recognized as an annual forum for the discussion of matters affecting the merchant marine, and they have been attended by many of the leading representatives of the shipping industry. This particular convention, coming as it did only a few days after the President had delivered his message to Congress, and at what we believe to be practically the beginning of better times for shipping, was no exception to the rule.

Senator Ransdell declared in his opening address that patriotic motives alone and the desire and determination to wisely advise the President on matters relating to handling the colossal problems of American shipping had influenced the Shipping Board to seek light from the best possible sources. The board in reaching its conclusions on the facts and findings that were submitted to the President was assisted by eleven of the best known experts who were chosen regardless of their political belief.

Senator Ransdell then proceeded briefly to analyze the Administration Bill. He said that the subsidy was the essential feature and that, although the term "subsidy" had been an offensive term to the American people of both parties in the past, the situation is altogether different now. He declared that the proposed rebate of 5 percent on the income tax of the total amount of freight paid on exports and imports would reach "the cotton grower of the South, the grain grower of the West and the producer and manufacturer of every portion of the United States who exports his products abroad or imports anything from abroad."

Before introducing the Chairman of the Shipping Board as the next speaker, Senator Ransdell pledged himself, "as one member of the minority party in the United States Senate, to stand by the general principles enunciated in the President's message to Congress." This statement was received with great applause.

Chairman Lasker's Address

The study and recommendations upon which the President's message and the Shipping Bill are based represent "the enthusiastic and the unanimous view of the Shipping Board," said Mr. Lasker. "Senator Ransdell is to be congratulated on being the first man to publicly and favorably analyze the President's message but what would you do," he asked, "if you had prepared an address and the speaker preceding you had covered the same story that you intended to present?"

"The merchant marine is now a vital necessity if America is to live up to its destiny and it is the President's ambition to go into history as the Administration under which it was established," he said. "As to need of a merchant marine, from a naval standpoint there can be no divided opinion." The need exists and there can be no question as to the duty of our people to establish it in a time of peace.

"It is well known that, by and large, American ships cannot compete with foreign vessels unless Government aid insures that they will have to be sold or dismantled. I am one who holds that Section 34 of the Jones Act would have done more than any other aid that could have been given to establish our merchant marine but the President did not consider this in view of our international relations as being in the national interest.

Navigation Laws Not Taken Up

"It is not proposed at this time to change our navigation laws. This is a subject in itself, but I believe that I can speak with authority when I say that the spokesman of sea labor feels that there are certain much-complained-of provisions in our navigation laws which in due course should be modified.

"It is proposed that the board sell its ships at world prices so that the owners will not be burdened with capital charges exceeding those of foreigners. The board cannot meet the need for passenger ships but it is possessed of an ample fleet of cargo ships to meet any needs for years to come.

"We have asked Congress to give us a constructive loan fund of $125,000,000 as soon as possible to be loaned at not less than 2 percent interest for the construction of the modern types of vessels that we lack. This is provided for in the Jones Act at the rate of $25,000,000 a year for five years but we have asked that the entire sum be made available at once for shipowners to give work to American yards who sorely need it.

"Referring to the income tax provisions, I should like to make clear that 5 percent of all freight moneys that have been paid to American ships for either inbound or outbound cargoes shall be deductible from the income and corporation taxes. This provision is in lieu of the benefits that would have accrued to American shippers from Section 34 of the Jones Act. It will benefit all shippers and insure full cargoes for American ships.

Immigration

"It is proposed to secure at least 50 percent of the immigrant traffic for American vessels and, from such countries as do not possess a merchant marine, 100 percent. If this provision had been a law during the time that immigration was at its peak, we would not have been in the sorry plight that we were in 1914 when we had only 15 ocean-going passenger ships.

"The Naval Reserve will cost about $650,000 the first year and reach a maximum of $3,000,000 when 30,000 men will receive an annual retainer of one month's pay for their naval rating. This provision would be the greatest insurance against hasty and expensive naval training such as was entailed in our last war.

"Government officers going abroad on official business will be forced to travel on American ships when such are available or pay for their passage out of their own pocket.

"It is proposed in the law to discontinue the Army and Navy Transport Service and transfer their patronage to privately-owned vessels. I believe that if the real figures were available it could be proved that it can be done much cheaper in privately-owned ships.

To Bring Philippines Under Coastwise Laws

"The same objections that we heard against bringing Hawaii and Porto Rico under the coastwise laws are brought forward to show that the Philippines should not be made to come under these laws. Since Hawaii and Porto Rico have been brought under the coastwise laws they have prospered as they never prospered before. In fact, anything that is proposed to be done for American ships meets with the same kind of false propaganda.

"Preferential rail rates on through-shipments by American ships is now a law of the land. The Shipping Board is

making an intensive study as to whether the adequate facilities as required by the law are in existence and, if such facilities exist, the Shipping Board will direct their enforcement.

Subsidy

"The direct aid is based on a combination of speed, tonnage and distance covered. It will cost about $15,000,000 the first year and will reach $30,000,000 at the end of five years. I will not go into details about the rates of compensation proposed but by the use of the formula worked out we will get a balanced merchant marine of the types of ships needed to properly cover our trade routes. The funds are to be derived from 10 percent of the custom receipts and from doubling the present tonnage taxes. The ships receiving aid will not be paid for the carriage of the mails, excepting parcel post, but the sum due for this will be paid by the Post Office into the merchant marine fund and should amount to about $5,000,000.

A Check Against Profiteering

"In order that there could be no charge of profiteering, the proposed law contemplates that the direct aid shall follow the individual ship to the extent of 10 percent of its earnings in any one year. The earnings above 10 percent are to be equally divided between the Government and the shipowner until the subsidy has been repaid after which the ship keeps all its earnings. Where the indirect aids are sufficient, the direct aid would come back to the Treasury. It is an automatic check on itself.

"If in certain trade, such as Australia, the aid proposed should not be sufficient, the Shipping Board is authorized to increase it. If, however, the Shipping Board makes an error in the amount of aid it gives, automatically a check is on the error, because after 10 percent, half of the profits go back to the Treasury.

"Here is a definite remedial and creative proposal. If you don't want to accept it, what have you to offer? But don't bring up the genius of America for she has no greater genius for the sea than other nations. If ignorance, if selfish interest, or those who profit by the *status quo* are able to confuse the issue, the opportunity of the moment which peculiarly calls for action will pass."

Congressman Scott's Address

Representative Frank D. Scott of Michigan gave some idea of the importance of foreign trade when he stated that $4,000,000,000 worth of manufactured products should be shipped abroad annually, and also that 2 out of every 10 bushels of wheat must be exported. He claimed that the discontinuance of discriminatory duties in the last century killed our merchant marine and that the Seaman's Act was doing the same thing now.

He said the Seaman's Act affected the Great Lakes shipping much more severely than the ocean and that Great Lakes shipping cannot prosper until this difference is recognized. He asserted that not one of the passenger and cargo vessels on the lakes is now stopping at the islands or intermediate points.

Mr. Scott then took a shot at the Shipping Board by saying that it had been created as a first aid and then promoted to family physician. "Duplication is a great evil," he said, "the Shipping Board should be abolished and all its functions transferred to the Department of Commerce."

Demand for Passenger Accommodation

According to Mr. W. A. Harriman, who was the next speaker, a good indication of the demand for passenger accommodations is the number of inquiries that are received every day at the offices of the United American Lines for space on the new liners *Resolute* and *Reliance*. These vessels, which are the latest and most modern additions to the transatlantic passenger service, will be filled to maximum capacity during the coming season.

Mr. Harriman said that it was encouraging to know that the country was beginning to realize the importance of the work that the shipowners are doing and that this work could only be efficiently carried on by private interests.

Mr. Harriman pointed out the advantage that Great Britain had over us in the matter of ships of specialized design. He said that even in the cargo ship class they had vessels that could steam at 15 knots with which on certain berths our 10½-knot vessels could not successfully compete.

A Good Business Proposition

Commander Stevenson Taylor, president of the American Bureau of Shipping, declared that he knew of no better business proposition for the country at large than the wise expenditure of from thirty to fifty million dollars per annum so that our immense fleet of merchant ships can be operated profitably under private ownership. He said in part:

"Foreign shipping to us, after a lapse of over a century of inanition, is a new industry. It is now the one industry in the United States which needs protection by Governmental means more than any other. Every other of our great industries has had Governmental protection—a protection that has increased the cost of ships—and has a natural protection due to the geographical location of the United States, that is to say, the protection of at least 3,000 miles of water on both sides of this continent. Only three miles from our shores the ships of the world meet on an equality of opportunity.

"We cannot expect to maintain American standards of living on the seas, and compete successfully with ships operated under the lesser standards of our competitors. It then becomes necessary for our Government to see that American ships are given the same protection which our other basic industries have and should receive wherever economic conditions make it necessary.

"We must have our own delivery system, if we are successfully to sell our excess products in markets open to world competition, a delivery that will protect our shipments against delays and against damage caused, as has been asserted, either by wilfulness or carelessness. If we do not dispose of all our surplus products our national business will not continue to be successful. Hence, if we treat our shipping in the foreign trade solely as a delivery system, it is worth whatever it may cost, when we consider the business of the entire nation."

The Middle West Attitude

"Aside from the fact that we must maintain a fair-sized merchant marine in order to make our Navy effective, the Middle West looks upon the merchant marine as a means to an end," said Malcolm E. Stewart, chairman of the Middle West Merchant Marine Committee. He advocated the arrangement of conferences in the principal industrial and agricultural centers of the interior. In this way, the manufacturer, producer and business man can coordinate their interests to such an extent that each of them is bound to see the advantage of joining forces.

"Although the only way that we can get the kind of service best suited to expand our foreign trade is by building up an American merchant marine," he declared, "every convenience is offered to ship over foreign lines. The agents of the foreign shipper are ever bombarding the shipper with detailed information, making him familiar with the details of making shipments on every kind of a ship except an American, while the American steamship companies have not gone after this business with the proper spirit of cooperation and helpfulness."

Mr. Stewart said that the shippers of the United States

(*Continued on page* 244)

Fireboat John Purroy Mitchel

By I. C. G. Cooper*

The commissioning of the John Purroy Mitchel brings the number of fireboats comprising the marine division of the New York Fire Department to ten, or one vessel to every 58 miles of the city's waterfront. The enormous shipping activities carried on in the port of New York place a heavy responsibility upon this branch of the Fire Department and the rare occasions of loss or damage by fire are due to the thoroughness with which it works.

THE latest addition to the floating fire-fighting equipment of the New York Fire Department is the up-to-date vessel recently built and delivered by the Standard Shipbuilding Corporation at Shooters Island, N. Y.

The *John Purroy Mitchel* is a notable example of modern fireboat design. The particulars of the vessel are as follows:

General Information

Service: Fireboat for New York Harbor.
Builder: Standard Shipbuilding Corp., Shooters Island, New York.
Owner: Fire Department, City of New York.

Characteristics

Length, overall	133′-7½″
Length, B. P.	121′-0″
Breadth, molded	27′-0″
Depth, molded	14′-9″
Draft, loaded	9′-6″
Draft, light	
Block coefficient	0.58
Midship section coefficient	0.95
Longitudinal coefficient	0.61
Speed, loaded, knots	10.5
Cruising radius, nautical miles	
Framing	Transverse
Class	American Bureau of Shipping

Tonnages

(In tons of 2,240 pounds.)

*Weight of Hull	207
**Weight Propelling Machinery	180
Deadweight Capacity	
Displacement	476

(In tons of 100 cubic feet.)

Gross register	334.75
Net register	227.63

* Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.
** Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, Machinery Space Auxiliaries, Fire Pumps and Pipe System.

Equipment

Anchors, (1) stockless	350 lbs.
Chain, ⅝″ galvanized B.B.B.	20 fms
(10) Fenders, oak with manila lanyards	

Rudder

Area, square feet	52.6
Dia. Stock, inches	6

Deck Machinery

Steering Gear, Hyde	5½″x5½″
Capstans, (1) Hyde	4½″x6″

Life Saving Equipment

	No.	Type	Length
Lifeboats	1		12′-0″
Liferaft	1		7′-4″x4′-0″

Propelling Machinery

Boilers

Number	2
Type	B. & W, watertube
Length	9′-0″
Width	9′-8″
Furnaces, per boiler	3
Fuel	oil
Draft	forced
Total heating surface, square feet	4,840
Working pressure, lbs. per sq. in.	200

Engines

Number	1
Type	Reciprocating
Size	18″x38″x26″ stroke
Horsepower, indicated	720

Propellers

Number	1
Type	R. H., 4 bladed, semi-steel
Weight, tons	1.61
Diameter	8′-8″
Pitch	10′-6″
R. P. M.	140
Projected area, sq. ft.	22 6
Developed area, sq. ft.	28.0

Auxiliary Machinery

Machinery Space

Condensers (1)	2,500 sq. ft. cooling surface
Feed water heater	1
Fuel oil heater, Coen type	6 section

Pumps:

(2) Oil fuel	6x4x6
(1) Air	9x18x9x18x12
(1) Main feed	9x6x10
(1) Donkey	9x6x10
(1) Circulating	12″ centrifugal
(1) Fresh water	4½x2¾x4
(1) Sanitary	4½x2¾x4

(2) Turbo driven fire rotary type.

Electric Equipment

Generator, (1)	10 k.w. 110 volts, 91 amperes
Radio	
Emergency	

Bunkers

Compartment	Cu. Ft.	*Tons
F. O. tank, port	870	22.3
F. O. tank, star	720	18.4
Total	1,590	40.7

*39 cu. ft. per ton.................gals. per bbl.

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
F. W. forward	1,200	33.3	..
F. W. aft	480	13.3	..
Total	1,680	46.6	..

Hull

The hull is built to meet the requirements of the American Bureau of Shipping and is further strengthened to withstand the possibility of work in ice, in the extensive waterways around the city, by closely spaced frames forward, additional breast hooks and thickened bow plating.

Two sturdy oak fenders extend along the sides. The upper, 10 inches by 10 inches, extends completely round the vessel at the level of the main deck and the lower, 8 inches by 8 inches, located 2 feet above the waterline, extends from the fore end aft for four-fifths the length. Each fender is faced with 6-inch by ¾-inch flat steel bars.

Angle bar framing is used with solid floors and reverse bars extending 18 inches above the top of the floor plates. The reverse bars are double in the engine room and on alternate frames in the boiler room. Beams are fitted on alternate frames.

The single deck has substantial stringers and tie plates and is sheathed with 3-inch Oregon pine 3½ inches wide with a 7-inch yellow pine margin.

A feature of the vessel is the spacious nature of this deck, allowing easy access to the various fire turrets and hose reels and permitting free action for the firemen at every point.

Spacious quarters are provided for firemen and officers forward and for engineers aft. Berths are of the single spring type with lockers underneath. A washroom for stokers is directly accessible from the stokehold through a passage, fitted with airtight doors at each end, which also forms the swash bulkhead of the oil fuel tank.

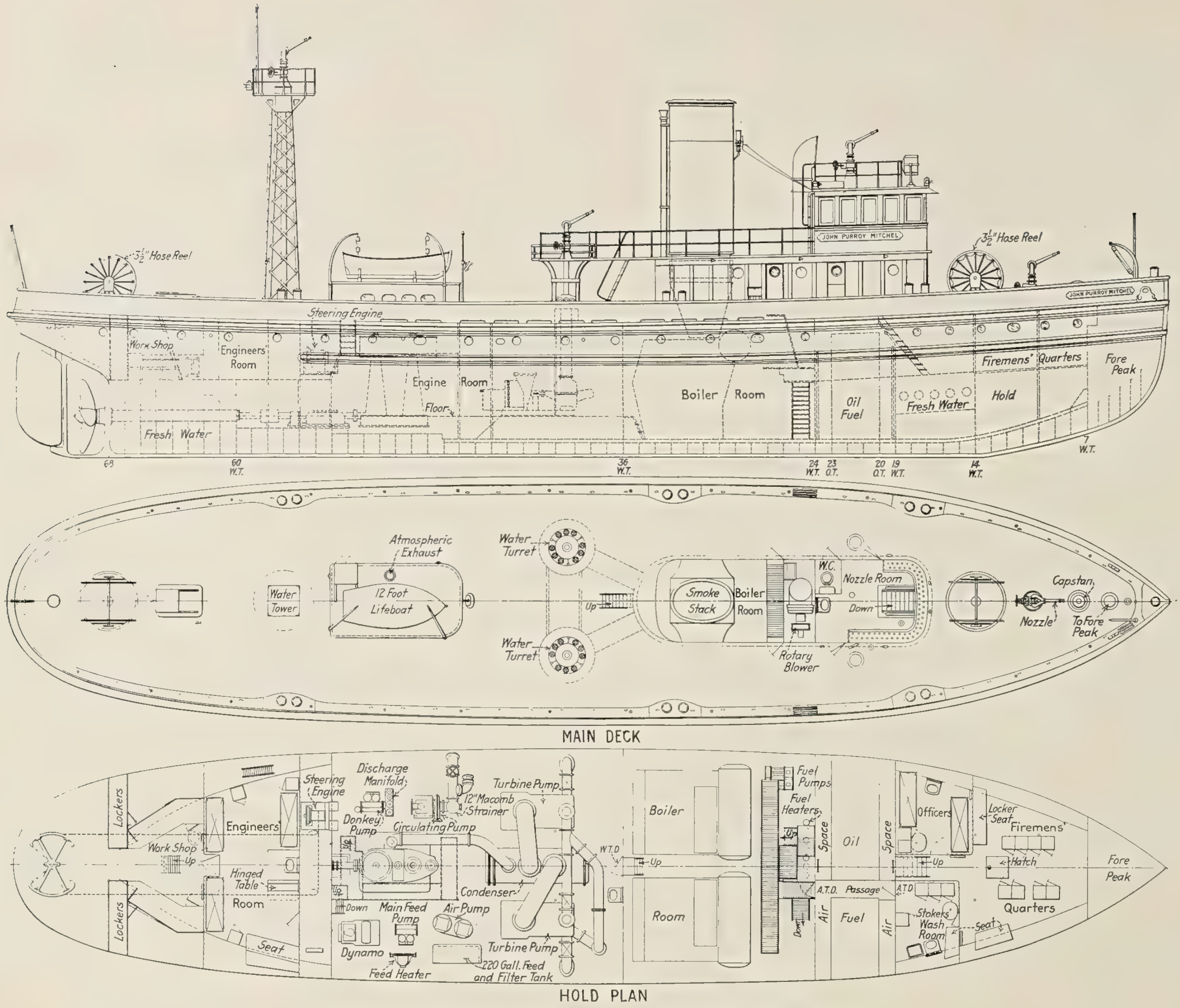
A well lighted workshop aft is fitted with two large benches and has ample locker and shelf stowage.

The entrance to the forward quarters, under the pilot house, is utilized as a nozzle room.

Main Propelling Machinery

The main engine is of the reciprocating, surface condensing type consisting of high pressure and low pressure cylinders with balanced cranks placed at right angles. All desirable

*Assistant to the naval architect, Standard Shipbuilding Corporation.



Profile and Deck Plans of Fireboat John Purroy Mitchel

auxiliaries have been fitted as shown in the table of particulars.

Boilers

The boilers are of the Babcock and Wilcox watertube type with large straight tubes designed for 200 pounds pressure and equipped for burning oil fuel on the system supplied by the Babcock and Wilcox Company at Bayonne, N. J.

The total capacity of the boilers is 29,000 pounds of dry steam per hour when working in a closed stokehold under a supply of 18,000 cubic feet of air at 1½ inches pressure. The air pressure is maintained by a rotary blower placed in the fireroom entrance at the main deck level, drawing from a 26-inch diameter geared cowl and delivering directly into the fireroom.

Oil fuel is stored in a special bunker, forward of the boiler room, protected by air spaces at the ends and on top.

The deck over the boilers is protected by 3/16-inch asbestos millboard laid over a complete sheathing of 6-pound plating.

Fire-fighting Equipment

A feature of the vessel is the completeness and power of her fire-fighting equipment. Water is delivered by rotary pumps, turbine driven, having a total capacity of 7,200 gallons of salt water per minute at a pressure of 175 pounds, or 9,000 gallons at a pressure of 150 pounds per square inch. The power is provided by two impulse type turbines developing 600 brake horsepower at 2,000 revolutions per minute under steam pressure of 200 pounds and exhausting into a condenser with 26-inch vacuum. The pumps are also cross connected so as to provide together a delivery of 4,500 gallons at 300 pounds pressure. The water is distributed through five large swivel nozzles mounted on the pilot house, after tower and forward deck and also through two midship turrets, each having 9 connections for hose.

Swivel play pipe holders are fitted at regular intervals in the 12-inch by 4-inch oak rail on the bulwark which is heavily constructed for this purpose.

Two reels on turntables, one forward and one aft, afford stowage for 1,000 feet of 3½ inch hose and two others are to be supplied which will stow 1,000 feet of 2½ inch hose and 1,000 feet of 1½ inch hose, respectively.

The substantial and workmanlike finish of the hull, machinery and fitting of the vessel, together with the up-to-date nature of the pumps make this a valuable addition to the city's fire-fighting force and will admit of a better distribution of the fireboats now in commission.

Trials

The boilers on trial were found capable of a much higher

evaporation than the contract called for. At one trial 35,000 pounds of steam were produced per hour against the specified 29,000 pounds.

Satisfactory results were also obtained with the turbine pumps.

The final full power speed trials were carried out on the Hudson River mile on November 9, 1921, in rather rough weather. Six runs were made with the following results:

Run No.		Speed in Miles	Propeller Revolutions per Minute
1	Against wind and tide....	13.28	160
2	With " " "	15.31	160
3	Against " " "	13.13	150
4	With " " "	15.42	150
5	Against " " "	13.33	150
6	With " " "	15.72	150

The mean speed was 14.3 miles per hour, and at 140 revolutions the speed was 13.75 miles per hour. Complete circles were turned both to port and to starboard in 2 minutes 12 seconds.

At 150 revolutions it took 24 seconds to completely stop the vessel when the engines were reversed.

The vessel was designed by Messrs. J. W. Millard & Brother, naval architects, 17 State street, New York, and the details were developed by the builder's drafting staff under the direction of Mr. Peter Mitchell, naval architect. Mr. F. Thompson, assisted by Mr. J. Woods, represented the Fire Department during construction.

Organization of Marine Division, New York Fire Department

There are now ten fireboats comprising the marine division of the New York Fire Department and each boat has a certain area that it covers on a first alarm. Two boats usually respond at each waterfront fire and if, during the absence of either of these boats, a second fire occurs, the boat from the adjoining district will respond. At least one boat responds to every waterfront fire. It is also possible to concentrate all boats at any particular point by means of a special signal.

An added duty and service of the fireboat fleet is to supply the high pressure mains in lower Manhattan and Brooklyn with salt water in an emergency. They can also be used to relay water to land engines operating a great distance from the waterfront, if for any cause the water supply has failed.

At a very serious fire the auxiliary fireboats, consisting of the tug boats of the various railroad companies, oil companies, steamship companies, etc., are called by a special signal to the Fire Department dispatcher at headquarters. These auxiliary fireboats are all equipped with pumps and have in the past performed effective work at fires.

The waters about the city of New York are at present divided for fireboat operation into districts as follows:

New York Harbor from Scotland lightship to buoy off Rockaway Point, Jamaica Bay, Staten Island Sound, Hudson River to Yonkers, East River including Gowanus Canal, Wallabout, Bushwick and Newtown Creeks, Harlem River, Long Island Sound, bays and tributaries to Sands Point.

The fireboats covering these districts are:

Name	Station	Length	Capacity in Gals. per Min.
The New Yorker	Battery	136'6"	12,000
Wm. L. Strong	Grand St., East River	110'0"	6,000
Zophar Mills	Beekman St., East River	120'5"	6,000
George B. McClellan	99th St., East River	117'0"	7,000
James Duane	35th St., North River	131'0"	9,000
Thomas Willett	Bloomfield St., North River	131'0"	9,000
Cornelius W. Lawrence	135th St., Harlem River	104'6"	7,000
Wm. J. Gaynor	37th St., South Brooklyn	118'0"	7,000
Abram S. Hewitt	Foot of Noble St., Brooklyn	117'0"	7,000
John Purroy Mitchel	Not assigned	132'0°	9,000

In addition to their duties about the city of New York, these fireboats have on numerous occasions rendered aid to cities and towns along the New Jersey shore.

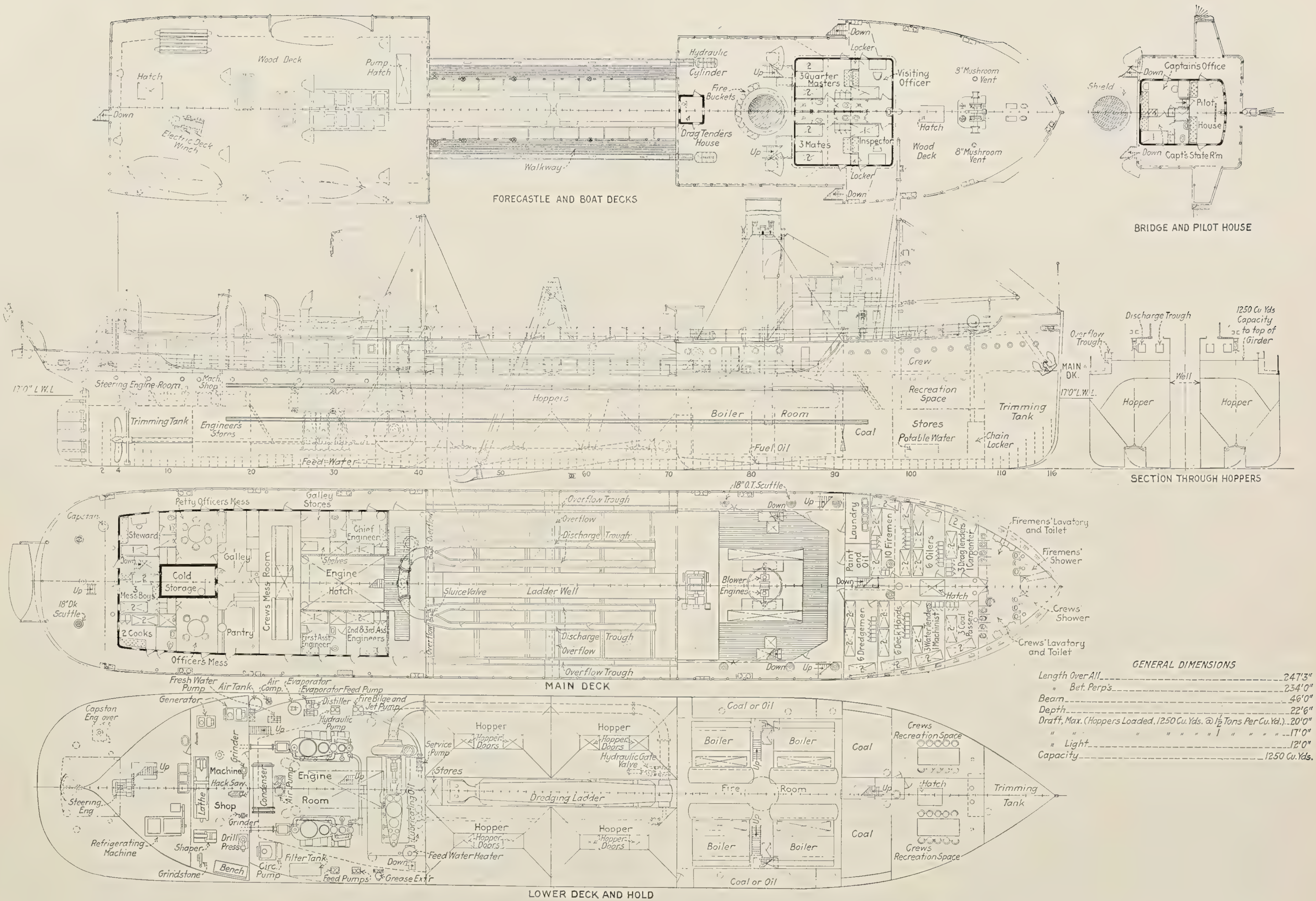
Oxy-Acetylene in China

THAT China, a country whose worship of antiquity has retarded its own development and progress until comparatively recently, is at last awakening to ideas and activities of the fast moving world beyond her domains is evident in many ways. One of these that is typical of her newfound modernism is the adoption of oxy-acetylene welding and cutting.

Welded Section of Rudder Frame

Welded Stern Post

The photographs reproduced herewith were secured through the courtesy of the Export Department of the Oxweld Acetylene Company. They show interesting work done by the Oxy-Acetylene Welding Works, at Shanghai. A rudder frame of the French S. S. *Cordillere* was broken, and the ruptured section (9 inches by 5 inches) was repaired by welding in four hours. The location of the weld is shown by crossed chalk lines in the photograph at the left. Another weld (on the stern post) is indicated by the arrow in the picture on the right. The work was done by Chinese labor.



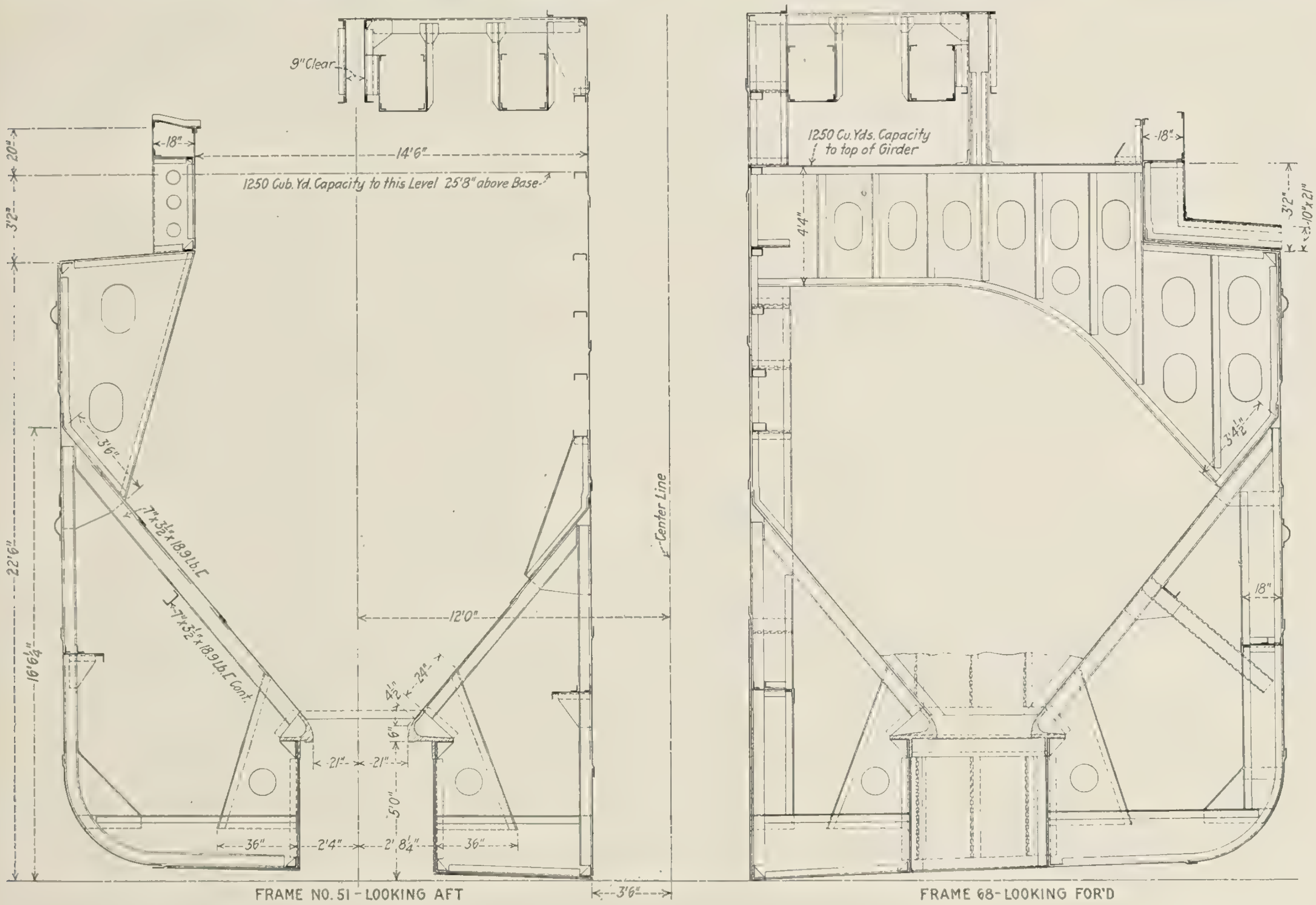
General Arrangement Plans of Sea-Going Hopper Dredge of 1,250 Cubic Yards Capacity

Sea-Going Dredge of 1250 Cubic Yards Capacity

Latest Design of Hopper Dredge for Use by the United States Engineer Department on Bar Dredging

By Theodore R. Vogel* and L. D. Norsworthy†

THE following description of the seagoing hopper dredge recently designed, under the direction of Brigadier General Harry Taylor, in the Marine Design Division of the Office of the Chief of Engineers, War Department, brings out many points of improvement over the former design of a similar type. The design follows very closely that of the *Col. P. S. Michie* which has the drag located in a well at the center of the hull and which was designed in the Office of the Chief of Engineers about ten years ago.



Transverse Sections Through Hoppers

The *Col. P. S. Michie* was designed primarily for use at Coos Bay, Oregon, where the severe weather conditions encountered made a specially designed dredge necessary for successful operation. This dredge has been in continuous operation since its construction in 1914 and has proved itself so superior to all other types that at a conference, held in the Office of the Chief of Engineers in February, 1920, it was agreed that future designs should be of the center well type with such improvements as have been developed since the *Col. P. S. Michie* was designed.

Criticisms of the hopper dredges in the various Engineer Districts of the War Department were received from the United States Engineers in charge of the districts with suggestions for their improvement. These criticisms were carefully analyzed and the following general principles established for the future design and operation of dredges:

(a) That a dredge is an expensive craft and economy is attained only when it is kept at work the greatest possible time throughout the year.

(b) That dredges of small capacity are uneconomical in operation as not enough space is available for a crew sufficient to operate the dredge twenty-four hours a day.

(c) That the machinery must be of the most efficient type and of such rugged construction that it will stand up under almost continual use, with the amount of time required for repairs, renewals, etc., reduced to a minimum.

In deciding to design a dredge of the center well rather than the stern well or side drag types, the following advantages of the former over the latter two types were considered:

The weight of the drag arm acts somewhat as a centerboard and thus tends to steady the dredge in rough weather. Further, after the drag has been lowered it remains on the bottom and at work practically all the time. This is a decided advantage over the side drag type where the drags

*Assistant engineer, in charge of Marine Design Division, Office of Chief of Engineers, War Department, Washington, D. C.
†Leading ship draftsman, Office of Chief of Engineers, War Department, Washington, D. C.

Sea-Going Hopper Dredge

General Information

Service:	Bar Dredging
Builder	
Owner:	Engineer Department, U. S. Army

Characteristics

Length, overall	247′-3″
Length, B. P.	234′-0″
Breadth, molded	46′-0″
Depth, molded	22′-6″
Draft, loaded with 1,250 cu. yds. at 1 ton per yd.	17′-0″
Draft, loaded with 1,250 cu. yds. at 1½ tons per yd.	20′-0″
Draft, light	12′-0″
Block coefficient, 17 ft. W. L.	0.772
Midship section coefficient, 17 ft. W. L.	0.975
Number of hoppers	4
Capacity of each hopper, cu. yds.	312.5
Total capacity of hoppers, cu. yds.	1,250
Displacement, tons, light	2,550
Displacement, tons, loaded with material at 1 ton per cu. yd.	3,800
Displacement, tons, loaded with material at 1½ tons per cu. yd.	4,575
Tons per inch immersion, 17 ft. W. L.	21.5
Dredging depth, feet	45

Equipment

2 Bower anchors, stockless, each	3,500 lbs.
1 Stream anchor, stockless	1,000 lbs.
Chain cable, 1⅞″ stud	1,440 ft.

Rudder

Area	
Dia. Stock	
C. Press. C. L. Pintles	

Complement

Officers	12
Crew	50
Shifts	3

Handling Equipment

	No.	Type	Capacity	Length
Masts	1	Pole		
Derrick posts	2			
Booms	1		5-Ton	
Booms	2		10-Ton	

Deck Machinery

Steering Gear, Steam driven type, telemotor control.

Windlass	(1) 8″ by 8″ double engine
Capstans	(1) 6″ by 8″ double engine
Winches	(1) 2½ tons, electric single line
Drag Hoist, (1) double line, 60 feet per minute, 22,400 lbs.	

Life Saving Equipment

	No.	Type	Length
Lifeboats	2	Metallic	24′-0″
Launches	1		24′-0″
Workboat	1		18′-0″
Life raft	1		14′-0″

Propelling Machinery

Boilers

Number	4
Type	Watertube
Length	
Width or Dia.	
Furnaces	
Fuel	Oil or coal
Draft	Induced
Total heating surface, square feet	11,040
Total grate surface or furnace volume	
Superheat, degrees F.	60
Working pressure, lbs. per sq. in.	225
Normal fuel consumption:	
Per day, tons	
Per horsepower hour, pounds	
Normal steam production:	
Per hour per pound of fuel	lbs.
Total per hour	lbs.

Engines

Number	2
Type	Triple expansion
Size	15″x26″x44″x26″ stroke
Horsepower, indicated	900

Propellers

Number	2
Type	
Weight	
Diameter	12′-0″
Pitch	
R. P. M.	100
Projected area	
Developed area	

Auxiliary Machinery

Machinery Space

Condensers, (1) 3,600 sq. ft. cooling surface	
Evaporators (1)	8,000 gals. per day
Distiller (1)	4,000 gals. per day
Feed water heater	Surface multicoil
Fuel oil heater	Auxiliary steam

Pumps:

1 Main circulating, 12″ centrifugal
1 Air, 12″x20″x12″ duplex
2 Feed, 8″x5″x12″ duplex
1 Fire, bilge and jet, 12″x10″x12″ duplex
1 Hydraulic, 10″x6″x10″ duplex
1 Fresh water, 4½″x4″x4″ duplex
1 Sanitary, 4½″x4″x4″ duplex
1 Service, 4½″x4″x4″ duplex

Pumping Engine

Number	1
Size	13½″x26¼″x36¾″x24″ stroke
R. P. M.	145
Horsepower, indicated	750
Type	Triple expansion

Dredging Pump

Number	1
Size of suction	26″
Size of discharge	26″
Diameter of impeller	6′-9″
Number of blades	5
Width of blade between shrouds	14″
Thrust	Kingsbury

Shop Machinery

1 16″ Lathe
1 18″ Shaper
1 22½″ Drill press
1 Emery grinder
1 Grindstone
1 Hacksaw
1 Drill grinder

Hopper Door Handling Machine
2 Hydraulic cylinders, 16″ diameter by 4′-0″ working stroke with pressure at 300 lbs. per sq. in.

Refrigerating Machinery

Type	Dumbbell
Capacity	2 tons

Electric Equipment.
Generators:
1 15 K. W. set
1 10 K. W. set

Bunkers

Oil

Compartment	Bbls.
2 Side bunkers, 650 bbls. each	1300
2 Bottom bunkers, 320 bbls. each	640
Total bbls.	1,940

Coal

	Tons
2 Side bunkers 75 tons each	150
1 Transverse bunker	200
Total	350

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Feed water, double bottom	100	....	

are continually lifted from the bottom due to the roll of the vessel, and also, if there is a cross current or cross wind, the offside drag has to be constantly lifted to prevent the dredge from sitting on and breaking the drag pipe. In regard to the stern well type the inherent disadvantage is that it will not steer well due to the heavy drag at the stern acting as an anchor. With the drag in a center well it is almost under the turning point of the vessel so that the dredge in steering practically uses the drag as a pivot on which to turn. Size for size the center and stern well types are both at a disadvantage when compared to the side drag type due to loss of buoyancy in the wells. This, however, is not considered serious as the increase in draft is comparatively slight. Then again the hull has the appearance of a commercial vessel with clear sides and has not the difficulty in lying at a wharf or making a landing that a dredge with drags, drag pipes, sponsons and davits on the sides does.

It was agreed that two sizes would be designed, one of 1,250 cubic yards capacity and one of 2,500 cubic yards capacity; the first dredge to have a load draft of 17 feet, with material in hoppers weighing one ton per cubic yard, and be of sufficient depth to give a freeboard of 2 feet 6 inches when loaded with material in the hoppers weighing 1½ tons per cubic yard; the second dredge to have a load draft of 20 feet with material in the hoppers weighing one ton per cubic yard and be of sufficient depth to give a freeboard of three feet with material weighing 1½ tons per cubic yard in the hoppers.

So far only tentative plans have been made for the second dredge.

Improvements Over Previous Designs

The points considered improvements over previous designs are as follows:

(1). Continuous main deck.
(2). Location of all quarters above the main deck.
(3). Provision for recreation space for the crew.

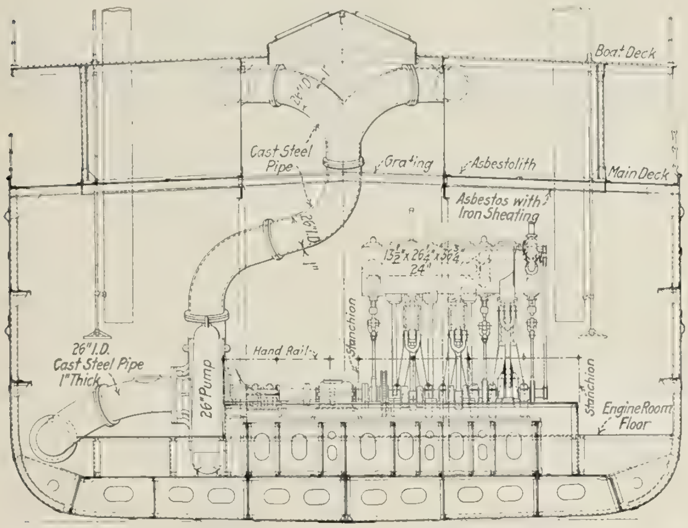
(4). Provision for sufficient quarters for three shifts of crew.

(5.) The elevation of hopper doors so that when opened they will not project below bottom of vessel. (This arrangement will allow the hoppers to unload should the dredge ground.)

(6). Omission of hips between the doors in each hopper.

(7). Replacement of hopper door chains with rods and the use of cast steel for the hopper doors and frames.

(8). Provision for dumping hoppers singly.



Transverse Section at Frame 35, Looking Forward, Showing Dredging Pump and Engine

(9). Provision for a 20-inch water cushion at the top of the hopper.

(10). Provision for a double discharge trough over each set of hoppers so that the discharge streams will oppose each other, tending to quiet the water and allow a better settlement of the dredged material.

(11). Overflow troughs from hoppers located outside of hoppers with discharge above deck.

(12). Increased length of dredge arm for dredging to a depth of 45 feet with arm at an angle of 43 degrees to the horizontal.

(13). Underside of dredging ladder fitted with plate so that center well is practically closed at bottom when ladder is in a horizontal position, thereby reducing eddy formation and increasing speed when dredge is under way.

(14). Lighter and narrower drag head.

(15). Water jets for drag, for use in dredging stiff material.

(16). Location of the drag operator's house and drag hoisting machine at forward end of hoppers so that the operator has a clear view of the discharges and the drag lines at all times and to increase the length of the leads from the drag hoist frame.

(17). Passageway from engine room to boiler room.

(18). Provision for greater accessibility to dredging pump.

(19). Provision for lifting dredging pump directly out of engine room.

(20). Installation of a dredging pump having a larger suction mouth and easier stream lines into the impeller.

(21). Increase in power of propelling engines to 900 indicated horsepower each.

(22). Triple expansion propelling engines.

(23). Installation of propellers with detachable blades.

(24). Outboard shaft protection device provided.

(25). Increased boiler capacity so that any three of the four boilers will furnish sufficient steam for maximum operation.

(26). Installation of steam superheaters.

(27). Installation of evaporator plant.

(28). Increase of fuel and water supply to provide for one week's operation.

(29). Provision for carrying either fuel oil or coal.

(30). Telemotor control for steering engine.

(31). Provision for hand steering.

The changes outlined above necessitated increasing the length 5 feet, breadth 3 feet and the depth 2 feet 6 inches over similar dimensions of the *Col. P. S. Michie.*

When the dredge is handling heavy material an additional 100 cubic yards can be carried in the hopper by eliminating the water cushion.

Operation

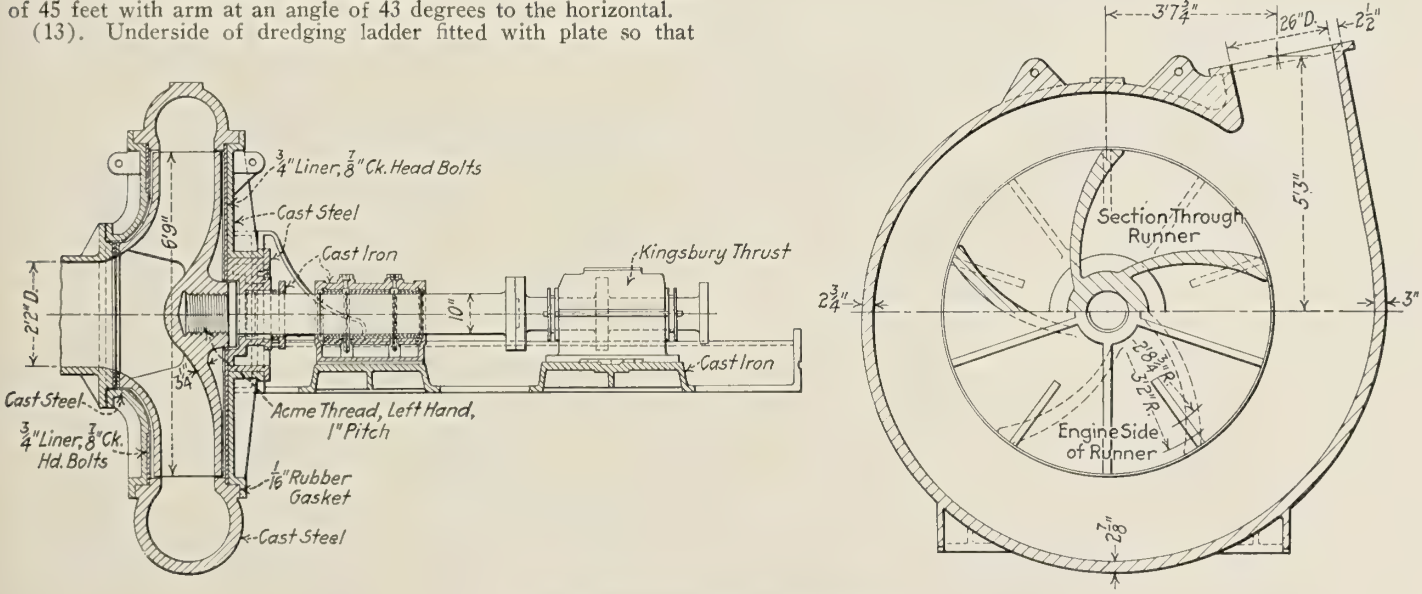
In operating, the dredge is kept moving forward at a speed of from one to two miles per hour with the drag down. The material is sucked up through a grid in the suction head, passes up through a 26-inch pipe in the drag arm to the trunnion, thence aft to the dredging pump. Just above the pump a "Y" pipe is fitted leading to double discharge troughs on each side of the well. These discharge troughs empty through adjustable doors into four large hoppers, each hopper having a pair of gates at its bottom.

Each hopper is fitted with an outboard and end weir, arranged to permit waste water to overflow into troughs which discharge overboard across the main deck.

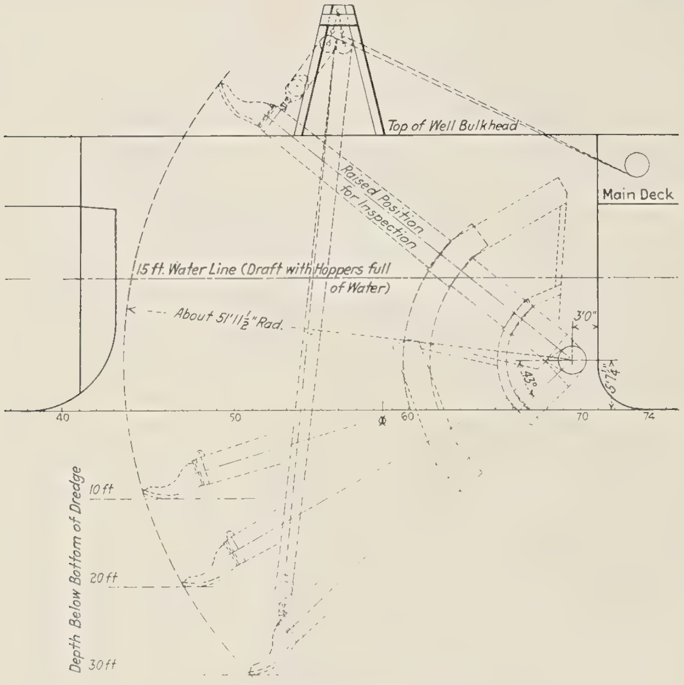
The hoppers and machinery have been so located that the dredge will trim practically on an even keel with no load or full load in hoppers, which allows an even flow of water into the overflow troughs. When the hoppers are full the dredge proceeds to the dumping ground, where the material is deposited by opening the hopper gates.

The drag arm, which contains a 26-inch suction pipe, is connected to the hull by means of heavy cast steel trunnions and is raised and lowered by means of wire rope falls.

Accommodations are provided for three shifts of crew to permit continuous operation of the dredge.



Details of 26-Inch Dredging Pump



Dredging Depth Diagram

The crew, firemen, oilers, etc., are berthed forward in commodious quarters in the raised forecastle.

Recreation rooms are provided on the lower deck forward where those off duty may lounge or read.

The engineers are berthed in quarters near the engine room and the deck officers in an upper deck house forward.

The captain's stateroom and office are located immediately aft of the pilot house.

Propelling Machinery and Boilers

The propelling engines, of which there are two, are of the triple expansion type capable of developing 900 indicated horsepower each at 100 revolutions per minute.

Four watertube boilers are provided of such capacity that any three will provide sufficient steam for maximum operations. By this arrangement, boiler cleaning can be done while the dredge is operating, thus avoiding the need of laying up for this purpose during the time when dredging can be done or the necessity of Sunday cleaning.

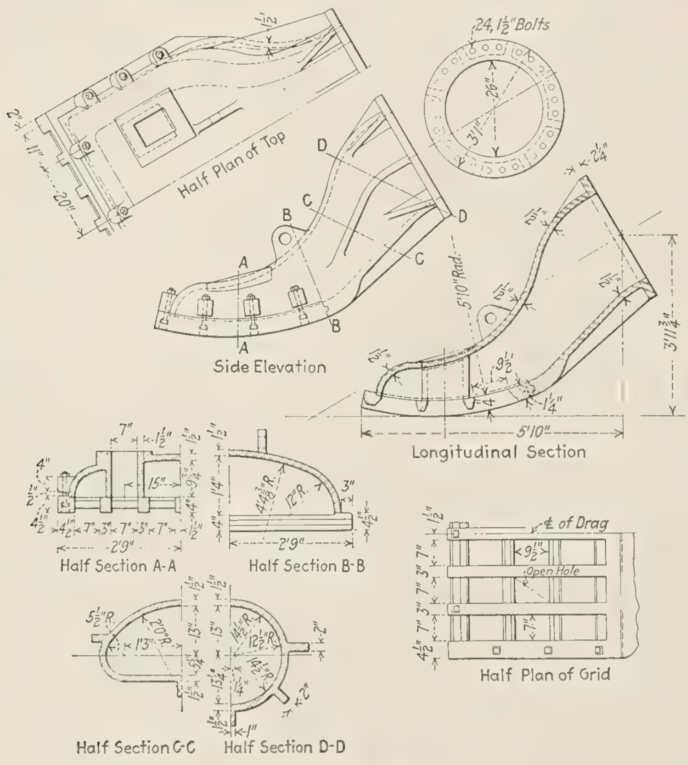
The boilers are placed forward of the hoppers so that their weight will counterbalance that of the machinery and keep the dredge on an even keel with no load or full load.

A passageway has been provided under the hoppers for communication between the engine and boiler rooms. This passageway also provides an additional escape from the fire room.

To compensate for the drop in steam pressure, due to the long steam pipe from the boilers to the engines, and as a source of economy in fuel consumption, steam superheaters have been provided to deliver steam with 50 degrees of superheat at the engines.

While the boilers are to burn oil primarily, provision has been made for changing to coal burning with a minimum of trouble, expense and time.

Induced draft blowers have been provided so that, in the event of coal being used for fuel, sufficient evaporation will be obtained from three boilers, the same as for oil, for maximum operation.



Drag Head Castings

Dredging Machinery

The pumping engine is of the triple expansion type direct connected, through a Kingsbury thrust, to the dredging pump and operates at 145 revolutions per minute.

The dredging pump is of the volute type having a 26-inch suction and discharge.

All bends in the suction and discharge pipes are given as large radii as practicable to reduce friction losses to a minimum.

The drag is of the flat face type with grids to limit the size of dredged material that may enter. The sum of the areas of the openings in the grid is equal to twice the area of cross section of the 26-inch suction pipe.

A water pressure system has been provided for supplying water under pressure to jets in a special drag for dredging in clay or hard packed sand. These water jets agitate or loosen the clay or sand for dredging.

The remarkable record of the *Col. P. S. Michie* has created a great deal of interest in this type of dredge and the Government has received a number of inquiries for detailed information regarding the latest designs from persons who follow up this line of work both here and abroad.

Plan for Cooperation Between Shippers and Shipping Board

Chairman Lasker and Vice-President Love, on March 4, met the committee appointed by the Middle West Merchant Marine Association, representing the chambers of commerce of twenty-five of the largest cities in the Middle West, headed by Malcolm Stewart of the Cincinnati Chamber of Commerce, to receive a report of the committee outlining the best form, in their opinion, of cooperation between shippers in the interior and the United States Shipping Board.

It has long been the desire of Chairman Lasker and Vice-President Love to bring about a closer working understanding between American shipowners and operators on the one hand and exporters throughout the country on the other, and plans had already been laid to this end. The intervening period has been used in order to so improve Shipping Board services as to enable its representatives to offer to exporters of this country services equal to, if not superior, to those maintained by the flags of other nations. In doing this, some eighty lines required consideration.

Motorship Dominion Miller, Built for the Furness, Withy Line and Fitted with One 3,000 Horsepower Doxford Oil Engine

3,000 Horsepower Single Screw Motorship

Doxford Engined Vessel of 9,400 Tons Deadweight Built for Furness, Withy and Company—Boiler Oil Proposed as Fuel

By Our Special London Correspondent

AT the end of February, trials were run of one of the most interesting motor vessels that has yet been completed, particularly notable in that it represents the largest type of motorship in which single screw machinery is installed.

With the increasing confidence now felt in the internal combustion plant, shipowners are asking that the normal twin screw arrangement which has been adopted, to a certain extent as a safeguard, should be abandoned and that the cheapness, simplicity, convenience and higher efficiency of single screw craft should now be gained. It is for this reason that some well known oil engine manufacturers such as Burmeister and Wain have developed a special type of Diesel motor suitable for installation in a single screw craft, the main difference from the normal design being that a longer stroke is employed and naturally a lower speed of rotation.

The First Furness, Withy Motorship

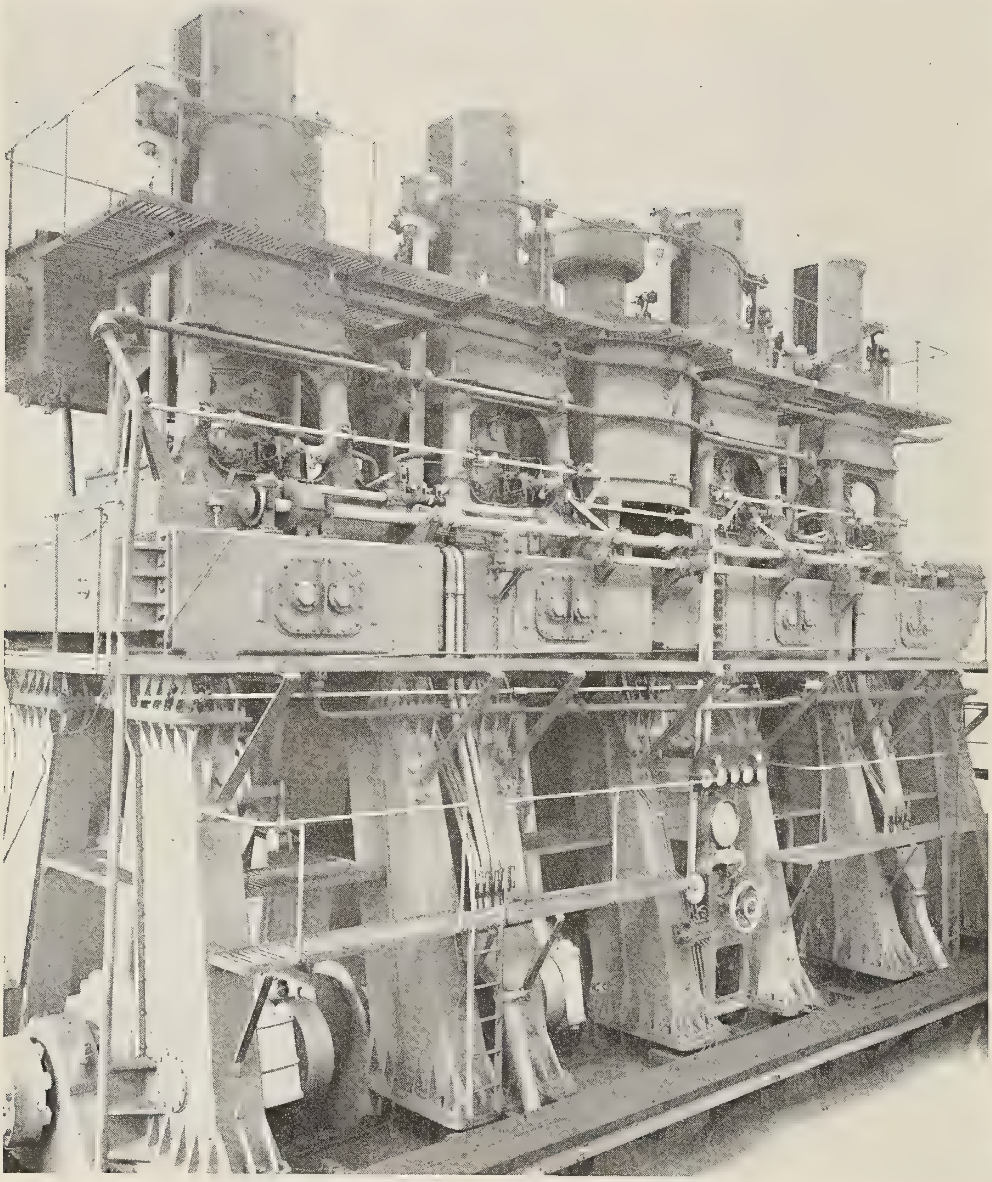
The Doxford opposed piston oil engine is intended essentially for single screw ships and incidentally is the highest powered internal combustion marine engine that has ever been built commercially. The vessel which was recently completed, the *Dominion Miller,* built for Furness, Withy and Company, is equipped with one of these Doxford engines and is in many respects similar to the Transatlantic Steamship Company's motorship *Yngaren* which has now been in service for two or three months. Incidentally the *Dominion Miller* is the first vessel built for Furness, Withy and Company and it is understood that this large concern —one of the biggest in Europe—will probably adopt a policy of motorship construction, should the results of this venture prove successful.

There are other features of special interest in this ship both for engineers and shipowners. Controversy rages around the question, whether what is known as boiler oil is suitable for use in internal combustion engines or whether it is desirable that only the higher grade and lighter Diesel fuel should be utilized. Manufacturers of two stroke engines claim that, with the absence of exhaust valves, boiler oil may be employed with complete immunity from trouble but up till the present time no European ship has run more than a few hours on end on boiler oil.

Seven-Day Test of Doxford Engine Using Boiler Oil

In order to satisfy themselves on this point, Doxfords recently ran a trial of 7 days' duration, during the whole of which Mexican boiler oil of a specific gravity of 0.95 was burned. According to the reports that have been published, the results were eminently satisfactory; the fuel consumption was equal to that attained on Diesel oil and, when the engine was opened out, it was in a perfectly clean condition.

On the strength of this, therefore, the owners have decided that after operating for a short time on Diesel oil in order to make quite sure that the engine is mechanically perfect, they will then run the machinery on a mixture of boiler and Diesel oil, and finally use only the former fuel. The experiment will be watched with the greatest interest since in many ports there is a very considerable difference in the price of boiler and Diesel oil, the former in England costing £3.15.0 and the latter £5.15.0 per ton.



3,000 Indicated Horsepower Doxford Opposed Piston Engine

dentally is the lowest speed that has yet been adopted in any marine Diesel engine. There are only four cylinders so that the output per cylinder is 750 indicated horsepower and as the brake power of the motor is 2,700, each specific cylinder output is 675 brake horsepower—easily the largest that has yet been attained.

The cylinders are only 580 millimeters diameter, which is much less than that of the biggest Burmeister and Wain eight cylinder 3,200 indicated horsepower engines and gives some indication of the possible advantage of the two stroke type. The stroke of each piston is 1,160 millimeters, giving a total effective stroke of the two opposed pistons combined of 2,330 millimeters.

The principle of the operation of the Doxford opposed piston engine is now fairly well known. The bottom piston drives direct on to a crank on the crankshaft and the crosshead of the upper piston is attached to two vertical rods joined at their bottom ends to connecting rods driving on to cranks, one on each side of the main cranks. There are thus, in all, thirteen cranks, including that driving the scavenging pump, and the difficulty of constructing the crankshaft is perhaps one of the chief points that has been urged against the Doxford engine.

The long stroke of the piston necessitates a liner over 10 feet in length and here again the greatest care in construction has to be exercised since this liner is pierced in the center for the reception of two fuel valves, one at the back and one at the front, in addition to the starting air and relief valves. The liner is ribbed, crosswise and vertically, for about a third of the length at the center and it is held at this point by the cylinder barrels, the remaining portion of the liner being free to expand. The scavenging ports are at the bottom of the liner and the exhaust ports at the top, the only mechanically operated valves being the two fuel valves for each cylinder and the starting air valves.

What is known as solid injection of fuel is employed in this engine, a battery of fuel pumps being driven from the crankshaft supplying fuel to the valves at a pressure of no less than 9,000 pounds per square inch. An auxiliary set of fuel pumps is installed in the engine room and this, like the other plant, is driven by means of a steam engine. Scavenging air is supplied from a vertical scavenging pump driven from the crankshaft and located between the two pairs of cylinders. Fresh water cooling is used throughout, supplied from steam driven circulating pumps, the fresh water being of course itself cooled by the circulation of sea water around it in a special cooler.

Details of the Vessel

The new vessel is very similar in hull dimensions to standard steamers which Doxfords have built for several years past. The following are the details and the dimensions:

Length between prependiculars	420 feet
Maximum beam	54 feet
Maximum draft	25 feet 6 inches
Deadweight cargo capacity, tons	9,400
Speed, knots	10½ to 11
Indicated horsepower	3,000

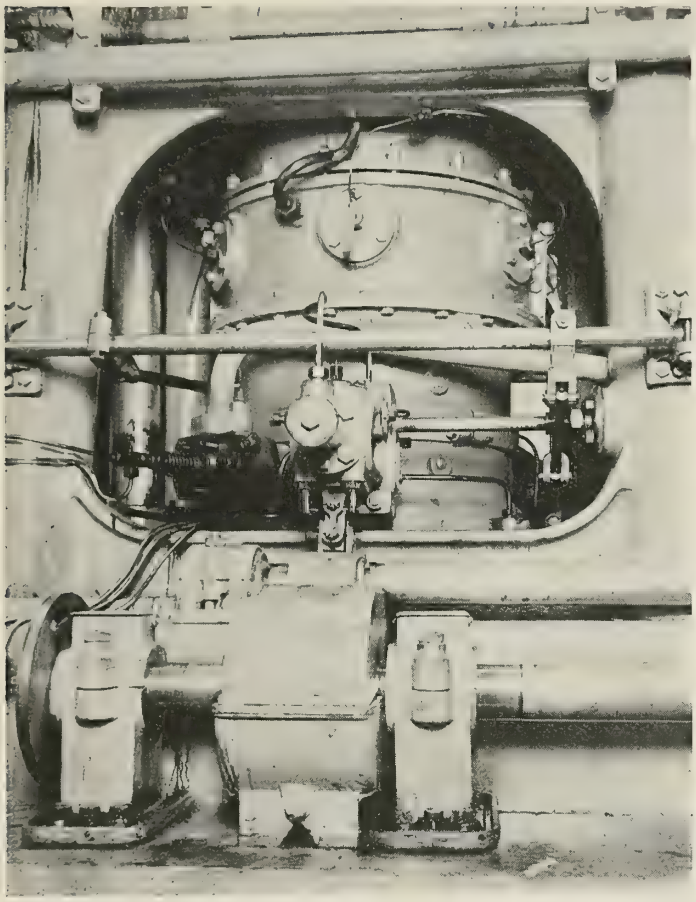
No special point of interest attaches to the construction of the hull, as it represents a cargo ship of normal design. The engine room is located slightly aft of amidships and, as for special reasons, all the auxiliary machinery is steam driven, two large boilers are installed in addition to the propelling and auxiliary plant. It is unusual in these days to find a motorship equipped with steam auxiliaries as it has been definitely proved that, in spite of the higher capital costs of an electrical plant, the saving in running expenses is so considerable that the increased expenditure is rapidly repaid.

Unusual Features of the Doxford Engine

The main engine develops its full power of 3,000 indicated horsepower at 77 revolutions per minute, which inci-

Control of the Engine

The control of the engine is simplicity itself and is effected solely by hand without the use of compressed air as is neces-



A Close View of One of the Cylinders of the Doxford Engine, Showing a Fuel Valve Through Which the Fuel Is Passed at a Pressure of 9,000 Pounds Per Square Inch

sary on all four cycle engines. A hand lever suffices to move the camshaft fore and aft to bring the astern cam (mounted side by side with the ahead cams on the camshaft) into operation. Starting and maneuvering are then effected by a small hand wheel and the control is much the same as with a steam engine, the hand wheel being gradually turned more and more to increase the speed. Its first action is to cause the levers actuating the starting valves to come on to their cams, thus allowing compressed air to be admitted to the cylinders and to start up the engine. On rotating the starting wheel further, the starting valve levers are taken out of action and those operating the fuel valves come on to their cams when the engine fires in the normal manner. Increased speed is attained by altering the lift of the fuel valves, this being carried out when the control wheel is rotated still further.

Engine Not of Cold Starting Type

One peculiarity of the Doxford engine is that as the compression is low, being no more than 280 pounds per square inch, it will not start up from cold and therefore has to be heated by passing steam through the pistons. This is a process taking about a couple of hours, so that this motor is not of the cold starting type and indeed cannot exactly be termed a Diesel engine at all.

Judging from the performance of the previous vessel with similar machinery, the *Dominion Miller* will have a daily fuel consumption of about 9½ tons for a speed of between 10 and 10½ knots when carrying her full cargo of 9,400 tons. According to Doxfords' experience, this compares with about 45 tons of coal on a corresponding steamer or about 25 tons of oil on a ship equipped with oil-fired boilers. The saving on the fuel bill is therefore on a large scale, particularly if it is found that the engine will operate successfully on boiler oil.

Application of Electricity to Deck and Engine Room Auxiliaries*

By C. H. Giroux†

As far back as 1900 the battleships *Kearsarge* and *Kentucky* were equipped extensively with electric auxiliaries and since that time this method of drive has been largely adopted by the Navy Department for all classes of ships. In spite of this fact there has been comparatively little progress made along similar lines in our merchant marine.

At the present time when cargo is scarce and competition is keen and when the supply of American vessels exceeds the demand, the shipowner must not overlook even the smallest item entering into the cost of operating vessels, otherwise the business may be a complete failure. A recent analysis of the performance of a large cargo vessel shows a return of 22 percent on the investment for electric auxiliaries. Where else can capital be invested with an equal return?

The problem of those who are advocating the general use of electricity on merchant vessels is first, to prove conclusively that electrical apparatus can be made reliable under marine conditions and then that the economy and low maintenance will warrant the investment of the necessary capital.

At the present time there are six steamships and two Diesel ships in merchant service propelled by electricity, the equipment for which was built by the General Electric Company. These ships, in charge of chief engineers having no previous experience with electrical apparatus, have made many voyages under all kinds of sea conditions and have proven themselves to be thoroughly dependable.

The General Electric Company has had a wonderful opportunity and has taken the trouble to make a thorough study of the operating conditions on many classes of merchant ships and has laid out plans whereby these same ships could save as much as ten or fifteen percent in the fuel consumption by the use of electric auxiliaries and by effecting a proper heat balance.

It is conservatively estimated that on a freight vessel propelled by a 2,500 shaft horsepower geared turbine, operating at sea for 220 days per year, the saving in fuel alone, which could be effected by the use of electrically driven auxiliaries, amounts to at least nine thousand dollars per annum.

The saving when the ship is in port is even greater than when at sea. The port consumption of cargo vessels with steam machinery varies from fifty to one hundred barrels of fuel per day when handling cargo, depending upon the size of the ship and the number of winches in use. These same ships, if equipped with electric engine room and deck auxiliaries, would consume from one-half to one-third of this fuel.

Little emphasis need be placed on the economy of electric auxiliaries when used with motorships for here the results are so remarkable that there is no basis of argument. I have extracts from the logs from two motorships, each driven by two 500 brake horsepower Diesel engines, one equipped with steam and the other with electric auxiliaries.

The donkey boiler for feeding the steam auxiliaries required an average of 557 gallons of oil per day at sea as compared with 42.5 gallons taken by the auxiliary engine for driving the electric motors.

On the motorship *Kennicott*, where electricity is used for all auxiliary purposes, the port consumption when loading or discharging cargo for ten hours is less than five barrels of fuel per day. This shows the possibilities where electricity is used for power.

*Extracts from a paper read before the Ocean Marine Engineers Beneficial Association. No. 80, New York.

†Marine Engineering Department, General Electric Company, Schenectady, N. Y.

Diesel-Engined Derrick Lighter Worthington

Vessel for Service in New York Harbor Equipped With New Type of Two-Cycle Solid Injection Worthington Diesel Engine

A NEW departure in the application of Diesel propelling and auxiliary machinery is found in the recent completion by the Vinyard Shipbuilding Company at Milford, Del., from designs prepared by Eads Johnson, naval architect, New York, of the self-propelled single screw Diesel engine-driven derrick lighter *Worthington,* built to the order of the Worthington Pump and Machinery Corporation, New York, to take the place of their steam derrick *Daniel Wheeler,* used for handling the company's products

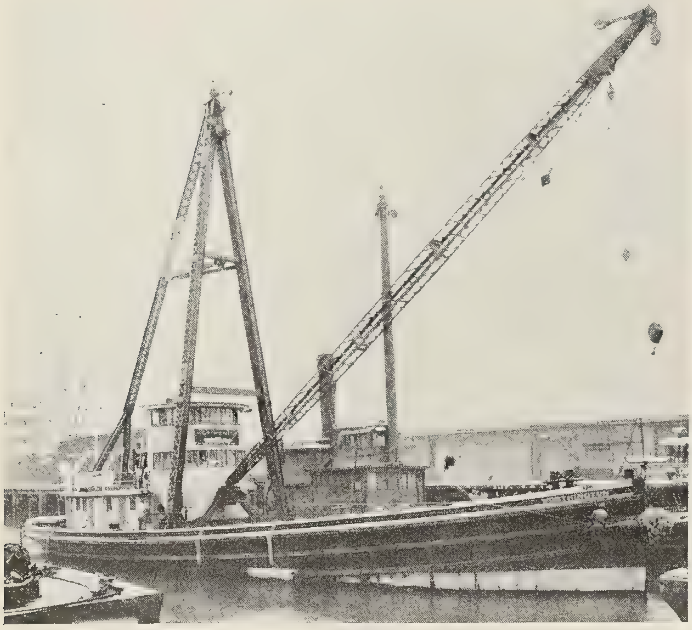


Fig. 1.—Derrick Lighter Worthington, Showing Arrangement of 20-Ton "A" Frame Derrick. Steam Lighter Daniel Wheeler in Background

in New York harbor and vicinity. Both the new and the old lighters are shown in Fig. 1.

In preparing the designs for this vessel, the naval architect collaborated with the Worthington company's engineers with a view towards achieving the most successful adaptation of this new type of power equipment to the special conditions of the service in which the boat is to be engaged. The derrick was built and installed by the Terry Manufacturing Company, New York.

The outstanding feature of this new lighter, aside from her size and the completeness of her equipment and accommodations, is the installation of a new type of Diesel engine, developed by the Worthington Pump and Machinery Corporation, for propelling the vessel and also for driving its main generator which supplies the current for the derrick motor, auxiliaries and electric lights. This engine is a two-cycle solid injection Diesel designed with a view to simplicity of construction and reliability of operation. As its weight per horsepower is about half that of the ordinary Diesel and its economy comparable with that of the ordinary Diesel, its simplicity and reliability of operation will appeal to marine engineers.

The hull of the *Worthington* is of wood, 133 feet long with a beam of 35 feet and a load draft of 10 feet. The gross tonnage is 333, the net tonnage 225. The hull is of unusually heavy construction to withstand the hard usage incident to service around the docks and harbor shipping and is full bodied in order to provide the necessary stability for operating the cargo derrick at long radii.

Derrick Equipment

An "A" frame derrick of 20 tons lifting capacity, of steel lattice work construction, is mounted abaft the midship line with a back leg extending to within a few feet of the stern. About 15 feet above the deck this back leg is divided into a fish tail, the two parts spreading out to within five feet of the rail on each side. The top of the "A" frame stands 70 feet above the main deck line. The derrick boom is 90 feet long and is stepped on a tripod base seven feet above the main deck. This construction permits the lighter to lie alongside high sided ships and handle cargo on deck or in the holds without using the ship's own cargo booms.

The derrick is mounted on foundations built up on fore and aft and athwartship trusses under the main deck and in the vicinity of the trusses and spaces between the frames and between the deck beams are filled in solid with timbers. Large U-bolts hold the derrick legs down and pass through the trusses to the hull framing so that all the stresses from the derrick are carried right to the bottom of the hull.

In a compartment just forward of the engine room is located the hoisting engine for operating the derrick. This is a five drum machine driven by a 25 horsepower General Electric motor and built by the National Hoisting Engine Company. The wire cable from each drum is led by means of suitable pulleys to a point directly beneath the derrick, then up through the deck to its proper place on the derrick. By means of reach rods and bell cranks the controls for all drums are operated by a bank of levers located in a glass enclosed operating room directly beneath the pilot house. A controller of the trolley car type for controlling the hoisting engine motor is also located in this room.

General Arrangement

In the space between the derrick "A" frame and the back leg is located the deck house containing living quarters for the crew, the operating room for controlling the derrick and the pilot house. From the "A" frame to the stem of the boat is clear deck space for cargo stowage. On boats of this type it is customary to carry all cargo on deck but on this vessel a large main deck hatch is provided so that perishable freight can be stowed in the hold, if it should be necessary to keep it on board for any great length of time.

At the level of the main deck in the deck house are two single and two double staterooms, one for the chief engineer, one for the assistant engineer, one for a deckhand and the cook and one for two deck hands. At the after end of the deck house on the port side is the galley, opening into the messroom on the starboard side. On the second deck in the deck house are two staterooms, one for the captain and one for the mate. On the same level and just forward of these two staterooms is the derrick operating room. Above the operating room is the pilot house, handsomely finished in hardwood. The appointments and finish of all the living quarters are somewhat above the average practice in harbor work boats.

The engine room is located in the stern and contains the main propelling engine, the electric plant for supplying cur-

rent to the derrick motor, auxiliaries and electric lights, an emergency lighting set, auxiliary air compressor, auxiliary lubricating oil circulating pump, auxiliary cooling water circulating pump, oil cooler, hot water heating boiler and starting air tanks.

Propelling Machinery

The main engine is a Worthington two cycle, solid injection, four cylinder Diesel engine, with cylinders 15¼ inches diameter by 16 inches stroke, developing 300 brake horsepower at 275 revolutions per minute. All of the control gear and fuel pumps are included in a sub-assembly at the forward end of the engine. On the after end, just abaft the flywheel is another sub-assembly consisting of a lubricating oil circulating pump, cooling water circulating pump, starting air compressor and mechanical cylinder lubricators, all driven from one eccentric. Attached to the aft end of the engine bed is a S. K. F. ball thrust bearing.

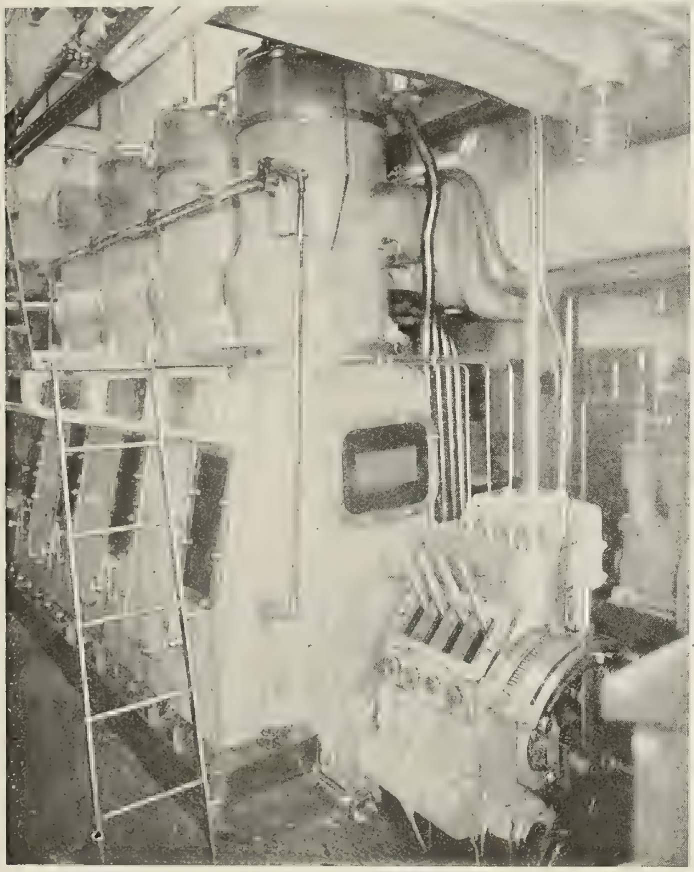


Fig. 2.—Starboard Side, Looking Aft, of 300 Horsepower Worthington Diesel Propelling Engine, Showing Control Assembly. All Operations Are Controlled from This Point

On the starboard side, forward is the electric generating plant consisting of a Worthington two cycle, solid injection, two cylinder, Diesel engine of 50 horsepower direct connected to a General Electric 38 kilowatt, direct current generator delivering current at 220 volts. A cooling water circulating pump, a bilge pump and a lubricating oil circulating pump are attached to this engine. This set supplies current for operating the derrick engine, the auxiliary air compressor, auxiliary pump and electric lights.

Auxiliaries

For pumping up starting air when the main engine compressor is not in operation, a Blake & Knowles (manufactured by the Worthington Company), two stage, motor driven compressor is provided. This compressor is provided with a Cutler Hammer automatic starter which can be set to maintain the air in the starting air reservoirs at any desired pressure, a combined pressure gage and electric switch making contact and closing the starting circuit to the air compressor motor when the air pressure in the tanks falls to the desired minimum and breaking contact when full pressure is reached. As long as the main attached compressor keeps the pressure in the starting air tanks between 250 and 350 pounds the auxiliary compressor does not operate but if engine maneuvers are made so frequently that the attached compressor cannot keep up the supply and the pressure falls to 250 pounds the starter gage closes the circuit, the auxiliary compressor starts without attention from the engineer and keeps running until the air pressure reaches 350 pounds, when the starter gage opens the circuit and the auxiliary compressor stops.

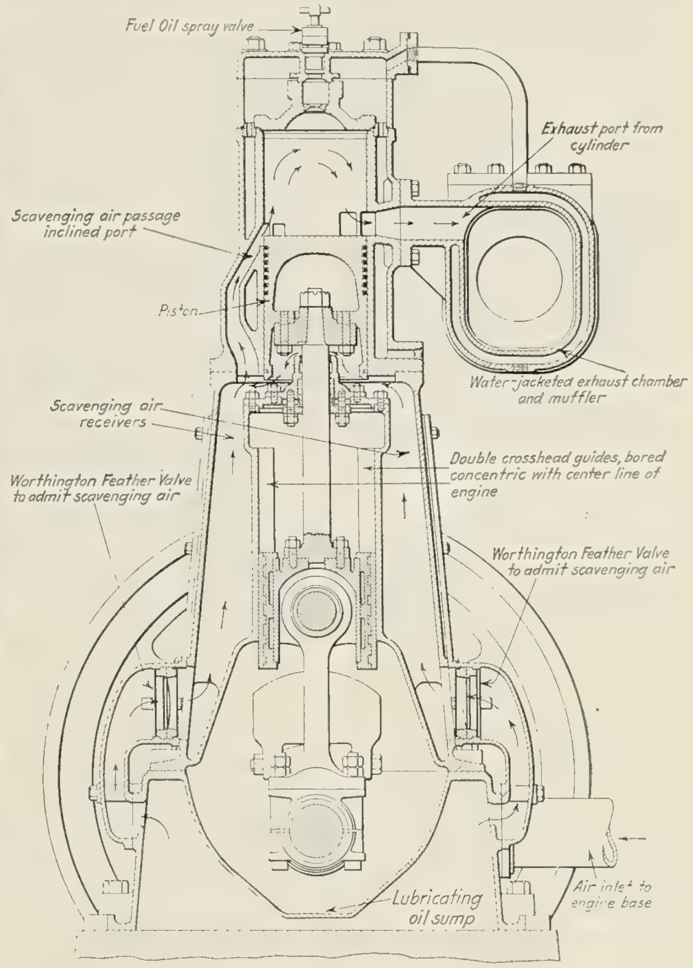


Fig. 3.—Section Through Engine

For emergency use, if the lubricating oil pump on either the main or auxiliary engine stops working, a motor driven rotary oil pump is provided. For emergency cooling water circulation a Worthington 2-inch volute, centrifugal, motor driven pump is provided. This pump has a connection to the bilge and can also be used to supply water to the fire hydrants on deck.

A Griscom-Russell vertical oil cooler is located in a very accessible position on the port side of the main engine and is so connected that it may be used to cool the bearing lubricating oil or in cold weather, if the oil is too stiff for proper circulation, the hot jacket water from the engine may be circulated through the cooler and the oil heated.

Electric Plant

For supplying current for lighting the boat or operating any of the auxiliary pumps when the 50 horsepower auxiliary set is shut down a Cummins oil engine of 7 horsepower is

provided, connected to a 6 kilowatt Triumph, direct current generator. This engine operates on the Hvid principle, burns the same fuel as the main engine and can be started by hand. If for any reason all the starting air should be lost, so that the 50 horsepower auxiliary engine cannot be started, this small set can be started by hand and will supply power enough to operate the auxiliary air compressor and pump up the starting air.

Starting air at 350 pounds pressure is stored in six cylindrical tanks of about 20 cubic feet capacity each, located in the extreme aft end of the engine room. This greatly ex-

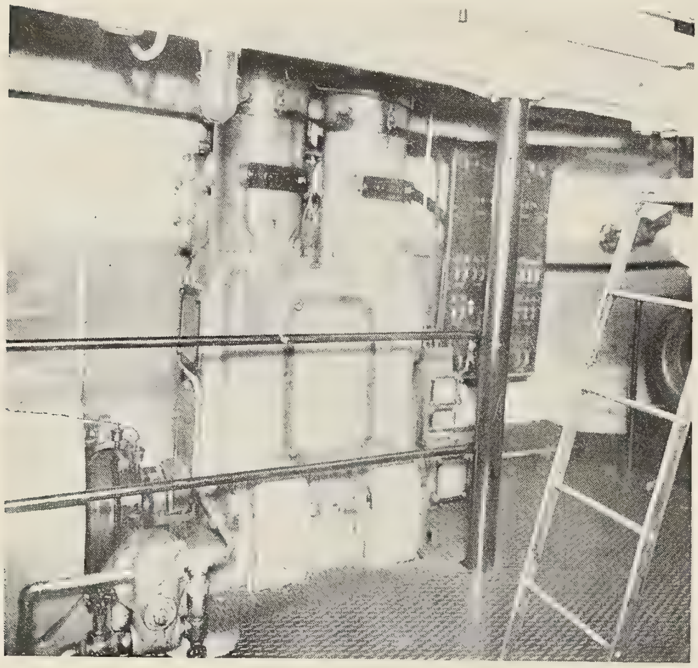


Fig. 4.—Worthington 50 Horsepower Diesel Engine Connected to 38 Kilowatt Generator for Supplying Current for Operating Derrick and All Auxiliaries. Switchboard in Background

ceeds the air requirements for the engine but the owners of the boat wished to be on the safe side and insure the boat against loss of maneuvering power in situations where very complicated maneuvers are required around crowded docks or among harbor shipping. In service it has been found that for normal operation two of these tanks are ample to meet the requirements.

New Type of Air Whistle Installed

Air at 100 pounds pressure for operating the whistle is stored in a tank that is a duplicate of the starting air tanks. Air is supplied to it through a reducing valve from the starting air reservoir. This tank was made of the same strength as the starting air tanks as a safety precaution in case the reducing valve should get out of order and permit full pressure of air to enter the tank.

In place of the conventional type of air whistle, which is notoriously ineffective as a sound producer and very extravagant in its use of air, the *Worthington* carries on top of the pilot house a Strombos duplex sound signal. This is a most effective sound device producing a very pleasing organ note, audible over long distances and requiring so little air that it is operated from a ¼-inch pipe.

The fuel supply is carried in two cylindrical steel tanks, of 4 tons capacity each, located outboard, one on each side in the hoisting engine compartment just forward of the engine room. At the main deck level in the engine room entrance, just above the main engine are located two daily service tanks each of sufficient capacity to operate the main engine continuously for six hours. A small pump driven from the crankshaft of the 50 horsepower engine transfers oil from the main tanks to the service tanks and a hand operated oil pump is provided as a standby. On the port side just forward of the fuel tank is a fresh water storage tank, while in a corresponding position on the starboard side is the lubricating oil storage tank.

Fire Fighting Equipment

In addition to the usual fire fighting equipment required by law additional protection against oil fires is provided in the form of a Foamite Firefoam engine of 80 gallons capacity installed in the forward part of the engine room hatch with sufficient hose attached to reach any part of the boat. In case of fire this machine is put into operation simply by opening one valve and the 80 gallons of mixture will produce 700 gallons of fire smothering foam under sufficient pressure to project it 50 feet from the hose nozzle. So effective is this apparatus for fighting oil fires that a very material reduction in insurance rate is granted by the underwriters where it is installed.

For heating the boat an Arcola hot water system of the ordinary house heating type is installed, the heating unit being located in the engine room. During the severe weather of the past winter this system proved so effective that it was found necessary to remove some of the radiators from the living quarters to reduce the heating effect.

Deck Machinery

For use in warping the vessel, pulling on lines, etc., a warping winch, driven by a 10 horsepower motor is located inside the deck house in the forward end of the engine room hatch, with a through shaft extending outside the deck house on each side and a drum on each end of the shaft.

It is worthy of comment that the boat was brought from

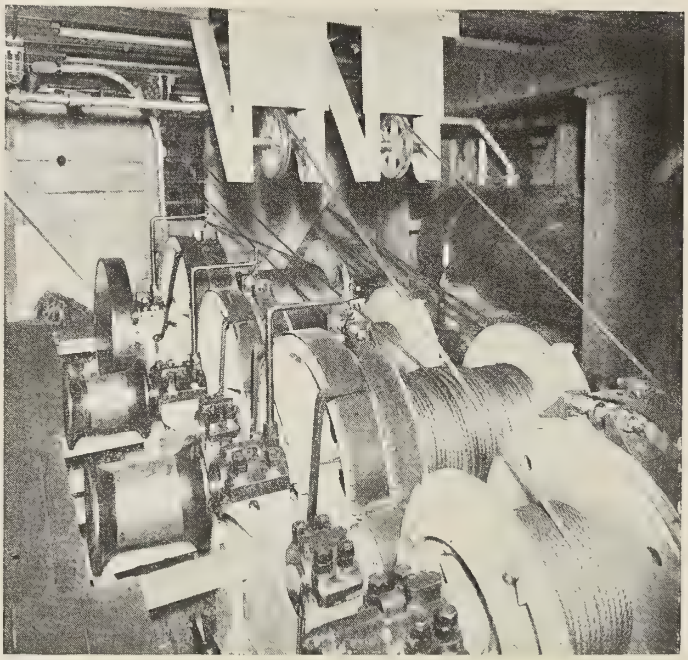


Fig. 5.—Electric Motor Operated Hoisting Engine for Controlling All Derrick Operations

the builders' yard to deep water in Delaware Bay through the shallow and tortuous water of Missapillion Creek under its own power, a trip requiring six days of almost constant maneuvering with the main engine. During this time the engine, although new and not "run in," met all the requirements of rapidly repeated maneuvers in a completely satisfactory manner, after which the vessel completed a sea trip in severe winter weather to New York without the slightest interruption.

Combined Ore and Oil Carrier Bethore, of 20,500 Tons Deadweight, Just Completed at Sparrow's Point (Md.) Plant of Bethlehem Shipbuilding Corporation, Ltd.

STEAMSHIP BETHORE COMPLETED

20,500-Ton Combination Ore and Oil Vessel Built by Bethlehem Shipbuilding Corp., Ltd.

THE S. S. *Bethore* delivered to the Ore Steamship Corporation on February 11, 1922, at the Sparrow's Point, Md., plant of the Bethlehem Shipbuilding Corporation, Ltd., is the second of the large combination ore and oil vessels to be completed at that plant. The first was the *G. Harrison Smith,* delivered to the International Petroleum Company on September 12, 1921.

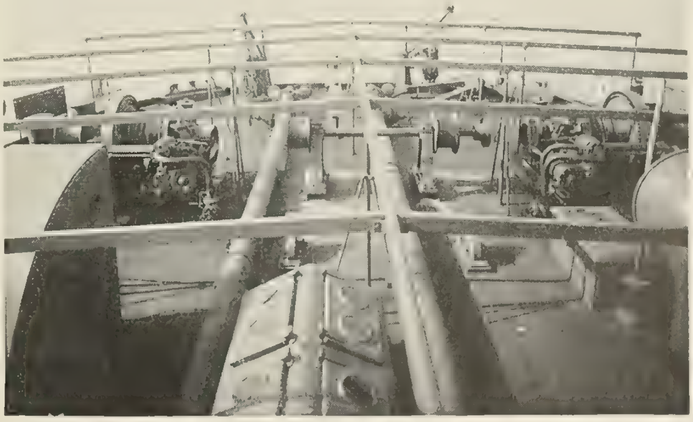
The commissioning of these steamers inaugurates the entry into service of a new type of vessel that has been developed to meet an economic demand in the construction of oil carriers. The *Bethore* is arranged with separate cargo spaces so designed and located that either a full load of oil or a full load of ore can be carried, or general cargo equal to approximately from one-half to one-third the deadweight capacity, according to density, can be carried. The utility of this type of vessel is apparent when it is recognized that it provides means for making a profitable return voyage after a cargo of oil has been delivered, thus enabling the ship owner to obtain 100 percent service from his fleet.

The ordinary tanker, as developed to date, is especially efficient in handling and transporting oil cargoes, yet suffers from the necessity of return voyages made in ballast. This condition means an economic loss which has been accepted as a necessary part of the industry. The advent of the combination ore and oil vessel, however, changes this situation and makes possible a greater return on the investment. Shipowners and operators are thoroughly aware of the necessity for economical operation and the importance of keeping their fleet moving with cargoes during the greatest possible number of days in the year, especially with present operating costs. That the construction of combination vessels is not necessarily confined to oil carriers, but may be applied as well to other types of freighters, is evidenced by the construction of two combination coal and ore carriers now building at the Union Plant, San Francisco, of the Bethlehem Corporation.

The *Bethore* is the first combination ore and oil vessel under American registry and ranks as one of the largest of all freight vessels afloat. There are undeniable economies and advantages in the use of vessels of great carrying capacity when conditions in their trade routes allow their use. This is true in the case of the *Bethore,* where the dimensions have been limited only by the depth of water available at loading and discharging terminals.

In design, the *Bethore* is of the patent combination ore and oil type and is similar, with some exceptions, to the *Marore* and *Steelore* now under construction at the Sparrow's Point plant and described in the April, 1921, issue of this paper. She was designed specially for carrying a cargo of oil from Mexico to South America, where the oil is to be discharged and a cargo of ore taken on for the United States,

Looking Aft from Bridge Deck, Showing 12-Inch Oil Cargo Discharge Line and Ore Hold Hatch Covers



Looking Aft on Poop Deck, Showing Two 12-Inch Stern Oil Cargo Discharge Lines

thus eliminating the necessity of making the return voyage under ballast as usually made by the ordinary tanker. General cargo can be carried on the trip to Mexico.

The general dimensions of the *Bethore* are in brief as follows: Length overall, 572 feet; length between perpendiculars, 550 feet; breadth, molded, 72 feet; molded depth, 44 feet; deadweight capacity, 20,500 tons, and displacement, 29,967 tons. Loaded, the draft is 32 feet 4⅛ inches, and light, the draft is 11 feet 3½ inches. The framing is longitudinal and the vessel is classed to the highest rating of the American Bureau of Shipping and British Corporation.

The principal cargo spaces in the *Bethore* consist of the cargo oil tanks and fuel oil tanks and the ore holds. The latter occupy a space 30 feet wide by 30 feet deep for a distance of 360 feet through the hull of the vessel, and are elevated 14 feet above the keel, which feature constitutes one of the inherent advantages of this type of ore carrying vessel. This ore space is divided by watertight bulkheads into three compartments. The oil cargo space contains 741,294 cubic feet, the fuel oil space, 141,160 cubic feet, and the ore cargo space of the three holds, 367,120 cubic feet.

The forward ore cargo hold is served by two hatches 30 feet long and one 19 feet long. The middle hold is served by three 30-foot hatches, while the after hold is served by two 30-foot and one 25-foot hatch. All hatches are 30 feet wide, the full width of the ore hold, and are of the corrugated patent Hogg-Carr type. Ten kingposts, with eighteen 36-foot Oregon pine booms of three tons capacity are provided for the handling of ore or general cargo in case the ship engages in a trade not having terminal facilities for loading and unloading. The ten 8¼ by 10-inch winches which handle the tackle for raising the hatch covers are available for working the ¾-inch diameter wire rope whips on the cargo booms.

The loading and unloading of an oil cargo is similar to the operations of an ordinary tanker.

In unloading ore, two 15-ton grab bucket unloaders will unload the vessel in about 40 hours.

The main engines in the *Bethore* are Bethlehem triple expansion reciprocating engines with 25-inch, 41-inch and 68-inch diameter cylinders and a 48-inch stroke. Steam is supplied by three Scotch boilers, 17 feet 6 inches in diameter by 12 feet long, built at the Sparrow's Point plant, fitted with Howden's system of forced draft and with the Bethlehem-Dahl mechanical oil burning system. In general both the engine room and deck auxiliaries, including the pumps, steering gear and mooring winches, were built by the Bethlehem Shipbuilding Corporation.

On her trial trips, on February 7 and 8, the *Bethore* more than met her requirements for speed. This vessel was designed for a speed of 11½ knots and over a measured mile off Kent Island developed a speed of 12.125 knots. A mean indicated horsepower of 5,557 was developed at 86.5 revolutions per minute.

National Merchant Marine Association Convenes

(*Continued from page* 228)

were not willing to remain at the mercy of foreign steamship lines but that our steamship operators must consent to be regulated and see their obligations to the shipper clearly defined.

Admiral Benson Given Ovation

Three lusty cheers and loud applause were given to Admiral Benson, a patriot and a fighter, who, after making an enviable reputation in the Navy, and, notwithstanding the fact that he was entitled to retirement from active service, was not afraid to handle the Shipping Board and its great problems practically alone in the face of acrimonious criticism.

The Admiral responded with a few words of explanation of the difficulties that he had labored under without the support of a full board before Mr. Harding's election and he also spoke of the necessity that he felt against doing anything to embarrass the incoming administration.

Mr. Franklin, president of the International Mercantile Marine Company, made a few extemporaneous remarks. He said that the President's message was excellent and exceedingly interesting even to people not in shipping. He hoped that all marine organizations would get behind the Shipping Bill as there was nothing so important for our merchant marine as this legislation.

Mr. Franklin said that it had a far better chance of passing than any previous bill and that, for the first time, support for such a measure could be obtained from the country at large.

Importance of Tramp Ships

Mr. Charles H. Potter, president of the United States Ship Operators' Association, stated that the Shipping Board selected its operating agents from owning and non-owning companies but that he hoped that before another year rolled around all these operators would then be classed as owners. Referring to the operation of tramp vessels by other countries he said in part:

"It is the policy of the Shipping Board to encourage and aid in the development of fast passenger, mail and cargo liners, also berth operations—and rightly so—for the very good reason that the Jones Bill so requires; but why, I ask, should the Shipping Board entirely and absolutely ignore tramp operations? I anticipate the reply will be to the effect that tramp operations are unprofitable—so are the operations of the combination passenger and cargo lines; also regular berth operations with possibly one or two exceptions. I submit that tramp operation is vital and therefore necessary to the ultimate success of a merchant marine. It is reported that since January 1, 1922, 242 foreign tramp steamers and only 51 American steamers have been chartered to transport bulk cargoes, principally from Atlantic United States ports and West Indian ports. These figures should be convincing evidence that foreign competitors are on the job; that they are taking advantage of our inactivities and short-sighted policy; and unless Government aid (either through an appropriation or subsidy) is forthcoming, and, I might add, revision of our antiquated and hampering navigation laws effected, we cannot hope to attain the goal to which we as a nation should aspire.

"The success of the British merchant marine is undoubtedly due to the large number of tramp owners rather than to the larger companies or combinations. Before the war the British fleet was divided about 60 percent tramp—40 percent liners. In recent years the larger companies or lines have deemed it necessary to buy tramp fleets in order that they might utilize these tramp vessels in supplementing the line ships on a berth controlled by conference. The tramps are not under conference regulations, and evasion of the conference rules was obtained by using uncontrolled tramps in a supplementary service. The Scandinavian countries, who have been most successful in shipping, have been principally tramp owners. Japan has also encouraged and developed its tramp tonnage. France and Italy have been principally owners of line vessels and their success has been very limited."

At the conclusion of the convention the delegates were received at the White House by the President. The President expressed his gratification at the assistance which the members of the Association had been able to render in studying the problems of marine legislation as applied to shipping.

Twisting Moments of Reciprocating Engines

Determination by Graphical Method and Use of Mathematical Formulae—Application of the Formulae

By Joseph Hecking*

THE laying-out of the twisting moment diagrams for reciprocating engines requires time and care. The work is considerably facilitated by the use of the graphical method, wherein the twisting moment at any crank angle equals the piston load at this angle multiplied by the distance between the center of the shaft and the intersection of the connecting rod with the horizontal centerline of the shaft, noted as "a" in the figures.

The mathematical formula for the graphical method is the following:

In accordance with the triangle of forces (Fig. 1).

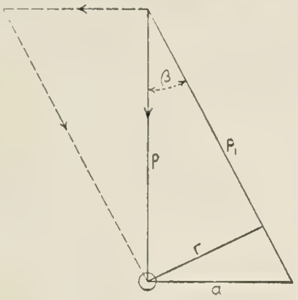


Fig. 1

$$P_1 = \frac{P}{\cos\beta}$$

where P = piston load, P_1 = force in the direction of the connecting rod. According to the law of similar triangles we have:

$$\frac{P_1}{a} = \frac{P}{r}$$

$$a \times P = P_1 \times r$$

The piston pressure to be taken from the indicator card at a point corresponding to the relative position of piston to crank. The inertia pressure per square inch of piston area at the various positions of the piston must be considered in the value of "p" and may be calculated for each engine or an average value may be assumed, depending on the type of the engine. It should be remembered that inertia is to be deducted from the working pressure for the first half of the stroke and to be added for the second half.

Torque Arm

Unless the torque diagrams are laid down accurately and to a large scale, errors are apt to occur in measuring values. The results of the graphical method may be readily determined mathematically without the construction of a diagram. The dimension "a" representing the leverage of the turning force may be determined as follows (see Fig. 2):

$$R = \text{ratio of connecting rod length to crank length}$$
$$m = \sin\alpha \times r$$
$$n = \cos\alpha \times r$$
$$\sin\beta = \frac{m}{Rr} = \frac{\sin\alpha \times r}{Rr} = \frac{\sin\alpha}{R}$$
$$s = \tan\beta \times n = \tan\beta \times \cos\alpha \times r$$

For upper half of stroke:

$$a = m + s = (\sin\alpha \times r) + (\tan\beta \times \cos\alpha \times r)$$

For lower half of stroke:

$$a = m - s = (\sin\alpha \times r) - (\tan\beta \times \cos\alpha \times r)$$

Piston Position

When the crank pin has traveled to the position of angle α the piston has moved through the distance "b," and the pressure of the lower position is measured from the indicator card. The length of the indicator card is taken as 2 r. The distance "b" is determined as follows:

$$t = \cos\beta \times R\,r$$

Upper half of stroke:

$$b = (R + 1)\,r - t - n$$
$$b = (R + 1)\,r - (\cos\beta \times R\,r) - (\cos\alpha \times r)$$

Lower half of stroke:

$$b = (R + 1)\,r - t + n$$
$$b = (R + 1)\,r - (\cos\beta \times R\,r) + (\cos\alpha \times r).$$

The values of "a" and "b" have been calculated by the above formulae for each 10 degrees of the crank and are tabulated in Table I on the next page.

Example: The indicator cards shown in the figures are taken with a 375 pound spring from a 4 cycle Diesel engine 24-inch diameter, 36-inch stroke, i. e., 1 inch height of the pressure curve represents 375 pounds pressure. The length of the connecting rod is 4½ times the length of the crank, R = 4.5.

For the 40-degree position of the crank the relative position of the piston, according to the table, b = .2803 × 18 inches = 5.05 inches from the upper position. Length of card 2r = 36 inches.

The piston pressure at this point is $\frac{19}{32} \times 375 = 223$ pounds and the piston load $223 \times .7854 \times 24^2 = 100{,}800$ pounds.

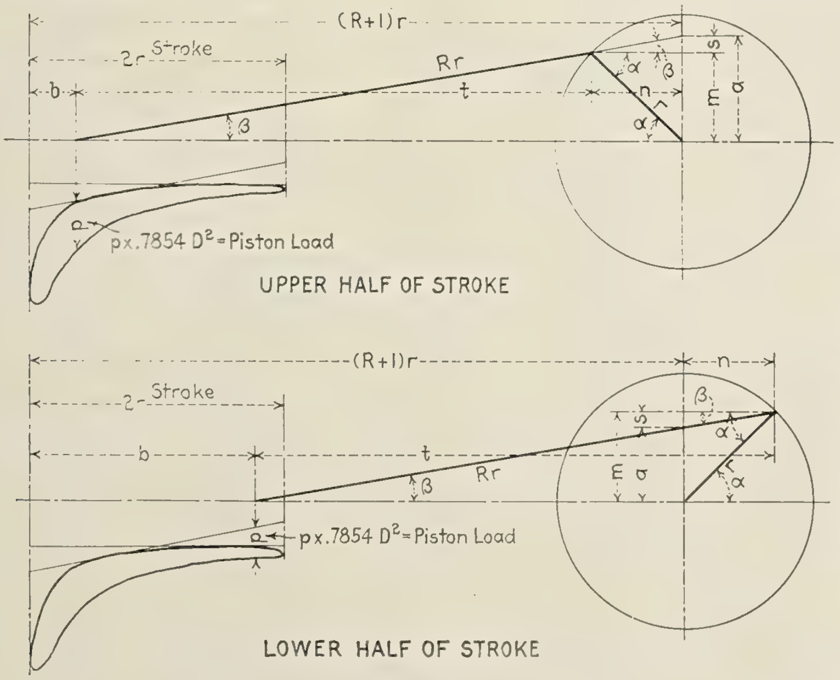


Fig. 2

*Engineer Surveyor, Scientific Department, American Bureau of Shipping, New York.

Table I—Values of "a" and "b" for Each 10 Degrees of the Crank

Crank angle from upper position	Ratio of connecting rod to crank lengths: 4		4.5		5		5.5	
	a	b	a	b	a	b	a	b
0	0	0	0	0	0	0	0	0
10	.2164	.0188	.2117	.0183	.2078	.0182	.2048	.0179
20	.4223	.0751	.4137	.0734	.4063	.0723	.4006	.0708
30	.609	.1652	.5965	.1619	.5866	.159	.579	.1566
40	.7673	.286	.7533	.2803	.7423	.2755	.725	.2714
50	.8892	.4312	.875	.4224	.8642	.4162	.855	.41
60	.9767	.5948	.9641	.5841	.9539	.5755	.9457	.5682
70	1.022	.77	1.013	.7575	1.005	.747	.999	.7389
80	1.029	.9488	1.024	.9358	1.02	.9244	1.016	.9155
90	1	1.127	1	1.113	1	1.101	1	1.092
100	.9406	1.296	.9458	1.283	.95	1.272	.9532	1.263
110	.857	1.454	.8667	1.442	.8743	1.431	.8804	1.423
120	.7553	1.595	.7679	1.584	.7781	1.576	.7863	1.568
130	.6428	1.717	.657	1.708	.6678	1.702	.677	1.696
140	.5183	1.818	.5323	1.812	.5433	1.808	.5606	1.803
150	.391	1.897	.4035	1.894	.4134	1.891	.421	1.889
160	.2617	1.955	.2703	1.953	.2777	1.952	.2834	1.95
170	.1308	1.988	.1355	1.988	.1394	1.988	.1424	1.988
180	0	2	0	2	0	2	0	2

Values of "a" and "b" to be multiplied by "r."

Turning arm "a" $= .7533 \times r = 13.56$ inches.
Twisting moment $= 100{,}800 \times 13.56 = 1{,}365{,}000$-inch-pounds.

For angles different from those given in the table the *formulae* should be used to obtain the corresponding values of "a" and "b." For different ratios of connecting rod to crank lengths it will be sufficiently correct to interpolate between values given in the table.

Application of Formulae

In multi-cylinder *Diesel engines* the crank shaft at the after crank transmits the combined torque of all the cylinders and is, in addition, subject to bending strains. (See "Diesel Engine Crank Shafts" in Marine Engineering and Shipping Age, February, 1921.) The line shafts are subject to twisting strains only, disregarding bending strains due to their own weight, and the moment of resistance (Section modulus $\times$ working stress) should not be less than T maximum found by the above formula, i. e., $0.196\ d^3 f =$ T maximum. The position of the crank angle for T maximum will be found near the 30-degree position for all engines excepting the 4-cylinder 4-cycle, where it is located near the 110-degree position. T maximum is therefore the sum of the twisting moments of one crank at the 30-degree position plus the twisting moments of all other cranks at their position in relation to the 30-degree angle. Similarly for the 4-cylinder 4-cycle engine as mentioned above. Diesel engines are usually fitted with flywheels which have the effect of equalizing the turning effort, thus reducing T maximum and increasing T minimum for the shafting aft the flywheel. It is not advisable to take full advantage of the reduction in T maximum but rather to calculate line shafts with a somewhat higher fibre stress "f" of 7,500 to 8,000 pounds per square inch.

In *turbines and motors* the turning effort is uniform and T mean = T maximum; the working stress "f" is usually taken at 5,000 pounds per square inch.

$$T\ m = \frac{S.\ H.\ P. \times 63{,}000}{R.\ P.\ M.} = 0.196\ d^3 \times 5{,}000$$

$$d^3 = \frac{S.\ H.\ P. \times 63{,}000}{R.\ P.\ M. \times 0.196 \times 5{,}000} = \frac{S.\ H.\ P. \times 65}{R.\ P.\ M.}$$

Steam Reciprocating Engines

Years of experience and common practice have established certain constants which may be used safely in calculating shaft diameters. T m is found by the well known formulae

$$\frac{plan}{33{,}000} = \frac{T\ m \times 6.28 \times R}{12 \times 33{,}000}$$

$$\text{or } \frac{p\ S\ D^2 R}{252{,}000} = \frac{T\ m \times R}{63{,}000}$$

$$T\ m = .25\ p\ S\ D^2 \text{ where}$$

p = mean referred pressure
S = stroke in inches
D = diameter of low pressure cylinder in inches
R = revolutions per minute

For compound engines $\dfrac{T\ max.}{T\ m} = 1.45$

and T max. $= 0.363\ p\ S\ D^2$

For triple expansion engines $\dfrac{T\ max.}{T\ m} = 1.33$

and T max. $= 0.333\ p\ S\ D^2$

For quadruple expansion engines $\dfrac{T\ max.}{T\ m} = 1.25$

and T max. $= 0.313\ p\ S\ D^2$

The fibre stress for the crank shaft is taken at 6,000 pounds per square inch and for the line shaft 7,000 pounds. For the crank shafts of compound engines, for instance,

$0.196\ d^3 \times 6{,}000 = 0.363\ p\ S\ D^2$, and for the line shafts

$$0.196\ d^3 \times 7{,}000 = 0.363\ p\ S\ D^2$$

The mean referred pressure "p" is dependent on the ratio of expansions and the card or efficiency factor; it is the theoretical mean effective pressure multiplied by the card factor.

The theoretical mean effective pressure for any number of expansions may be taken from any engineering handbook.

The ratio of expansions $= \dfrac{1}{\text{percent cut-off}} \times$ ratio of cylinder volumes. Inasmuch as the stroke of all cylinders is the same, the ratio of cylinder volumes is the same as the ratio of their diameters squared.

It is more convenient to express "p" as a fraction of the absolute boiler pressure P (working pressure + 15 pounds). The process of obtaining the values of p for various cylinder ratios and engines is given in the following table taken from the *Bulletin of the American Bureau of Shipping.* The values of shaft diameters obtained from these factors represent closely the requirements of the American classification society.

Cyl. Ratio L^2/H^2	Ratio Expansion	Theoretical m. e. p.	p = m. r. p.
Compound engines. Cut-off .6, card factor .63.			
3	5.0	.522P	.328P
3½	5.83	.474P	.298P
4	6.67	.434P	.274P
4½	7.5	.402P	.253P
5	8.33	.374P	.235P
Triple expansion engines. Cut-off .7, card factor .58.			
5	7.15	.415P	.241P
5½	7.85	.390P	.226P
6	8.58	.367P	.213P
6½	9.29	.347P	.201P
7	10.0	.330P	.191P
7½	10.71	.315P	.183P
8	11.43	.301P	.174P
8½	12.14	.288P	.167P
9	12.86	.276P	.160P
9½	13.57	.266P	.154P
10	14.29	.256P	.148P
Quadruple expansion engines. Cut-off .7, card factor .55			
7	10.0	.330P	.181P
7½	10.7	.315P	.173P
8	11.43	.301P	.165P
8½	12.14	.288P	.158P
9	12.86	.276P	.152P
9½	13.57	.266P	.146P
10	14.29	.256P	.141P
10½	15	.247P	.136P
11	15.72	.239P	.131P
11½	16.43	.231P	.127P
12	17.15	.224P	.123P

Steering Machinery—Merchant and Naval Types

Calculation of Forces Acting on Rudders—Power Required for Steering Engine—Description of Steam, Hydraulic and Electric Steering Gears

By George Murray

WHEN a ship is under way most of the forces acting on the rudder may be easily calculated, if we know the following particulars: Immersed area of rudder to waterline; speed of vessel; distance of center of gravity of rudder from centerline of rudderhead, usually termed center of pressure; angle the rudder makes with the centerline of ship.

Rudder Proportions

When not given by the shipbuilder the proportions of the rudder may be estimated.

$$\text{Area} = A = \frac{L \times D}{70}$$

A = immersed area of rudder in square feet.

L = Length on waterline between perpendiculars in feet.

D = draft in feet.

$$\text{Center of pressure} = L_1 = \frac{A}{D} \times C.$$

L_1 = center of pressure in feet.

A and D as for immersed area rudder.

C = a value based on the sine of rudder angle, with the following limits:

Angle 10 degrees = .248
20 degrees = .300
30 degrees = .347
35 degrees = .37
40 degrees = .391
45 degrees = .41

As the rudder stocks of vessels of ordinary proportions have their dimensions made to either the rules of a classification society in the merchant class or the accredited formula derived from experience in naval vessels the machinery operating these rudderstocks ought to conform to standard dimensions or capacities instead of the existing system, wherein the maker of this important marine auxiliary with the consent of the shipbuilder is free to install machinery with a very small margin of power over resistance. It will be noted from the July, 1920, *issue of* MARINE ENGINEERING *that Great Britain is about to set up in several districts panels with the idea of obtaining uniformity in deck fittings and auxiliaries including steering gear.*

If the rudder is rectangular and the angle the rudder makes with the centerline of the ship is 35 degrees, then the center of pressure is approximately three-eighths of its width. When the rudder is rounded the area may be obtained by Simpson's rule.

Balanced Rudders

When the rudder is balanced each part may be dealt with separately. Usually the forward part is smaller than the after part, therefore the resistance of the former would be deducted from the latter and the difference would give the actual resistance of the rudder to turning or the turning moment of the rudder.

Turning Moment

The resistance to turning or turning moment may be ascertained by substituting the proper values for the factors in the following rule:

If turning moment = M_t

Formula I. $$M_t = \frac{A \times V^2 \times L_1 \times C}{R} \times T = \text{foot pounds.}$$

A = immersed area of rudder in square feet.

V = speed of ship in knots.

L_1 = center of pressure in feet.

T = travel of chain in feet, i. e., proportion of circumference of quadrant embracing the angle "hard over" to "hard over."

R = radius in feet, center of rudder stock to center of chain on quadrant.

C_1 = a number based on the rudder angle with values as follows:

H.O. to H.O. 70 degrees = 1.8
80 degrees = 2
84 degrees = 2.5
90 degrees = 3

Alternative Method

Formula II. $M_t = A \times \sin Q \times P_1 \times L_1.$

A = immersed area rudder in square feet.

Q = angle rudder makes with centerline of ship.

L_1 = center of pressure in feet.

P_1 = pressure on rudder in pounds per square foot, i. e., $1.12V_1^2$ (see Table I).

V_1 = speed of ship in feet per second plus 10 percent.

Alternative Method

To facilitate calculations by Formula II, Table I is useful.

It is not always possible to arrive at the turning moment by the formulæ above, owing to the information supplied by the shipbuilder consisting only of the diameter of the rudder stock and probably the length, draft and speed of vessel. The turning moment is then obtained from the strength of the rudder stock. It is the practice of many makers of steering machinery to allow a stress on the rudder stock well within the limits of ultimate breaking point as Table II shows.

Table I—Pressure in Pounds Per Square Foot

Knots	Pressure P_1 Lbs. per Sq. Ft.	Knots	Pressure P_1 Lbs. per Sq. Ft.
7	189.2	17	1,118
8	247.4	18	1,253
9	313	19	1,396
10	387.3	20	1,546
11	468.7	21	1,705
12	557.4	22	1,872
13	653	23	2,046
14	758	24	2,227
15	870	25	2,416
16	990		

For the purposes of this article it will suffice to assume there is no bending moment transmitted to the rudder stock by the quadrant, tiller or other attachment and that a simple turning effort is all that we allow for, using the strength of the rudder stock in accordance with the table for a given diameter of stock. If the turning moment is given, the diameter is found as follows.

We have the strength of stock from the following familiar formula:

TABLE II—TORSIONAL STRENGTHS OF STEEL RUDDER STOCKS

Diameter, Inches.	Breaking Strength, Inch-Tons.	Elastic Limit, Inch-Tons.	Turning Moment Applied by Gear = 2/3 Elastic Limit, Inch-Tons.
5¼	846	348	232
5½	976	385	275
6	1,272	511	342
6½	1,618	575	383
6¾	1,812	644	429
7	2,020	718	479
7¼	2,245	798	532
7½	2,485	884	589
7¾	2,742	975	650
8	3,016	1,072	715
8¼	3,307	1,176	784
8½	3,617	1,286	857
8¾	3,946	1,403	935
9	4,294	1,527	1,018
9¼	4,662	1,658	1,105
9⅜	4,850	1,725	1,152
9½	5,051	1,796	1,197

$$\frac{f}{y} = \frac{M_t}{I}$$

where $y = \frac{D}{2}$; $f =$ limiting stress; $I =$ moment of inertia of section. Now $f = \frac{M_t \times D}{I \times 2} = \frac{M_t \times D}{\frac{\pi}{32} D^4 \times 2} = \frac{M_t \times 16}{\pi D^3}$

$$D^3 = \frac{M_t}{\frac{\pi}{16} f}. \quad D = \text{diameter of stock.}$$

For *f*, the usual stress allowed is 5 tons per square inch. From the foregoing, having arrived at the turning effort necessary to overcome the resistance offered by the pressure on the rudder with the ship under way, we may proceed to determine the power of the steering gear or engine.

Merchant Type Gears

In the merchant pattern of steering engine it is customary to base the engine power on the assumption that one of the cylinders in a two cylinder engine is required to overcome the friction of the gear and all the rudder connections. With a gear similar to Fig. 1 the power is obtained as follows:

Formula III. $A \times P \times 2S \times R =$ foot pounds (engine power) where

- $A =$ area of one cylinder in square inches.
- $P =$ working steam pressure in pounds per square inch.
- $S =$ stroke in feet.
- $R =$ revolutions of engine "hard over" to "hard over."

The revolutions of the engine $R = \frac{G \times H \times N}{M}$

where

- $G =$ circumference of quadrant at pitch line of chain.
- $H =$ fraction of circumference moved from H.O. to H.O.
- $N =$ number of teeth in worm wheel.
- $M =$ circumference of barrel at center of chain.

The diameter of the chain barrel should be at least 12 times the diameter of the chain.

There is no fixed ratio of engine power to turning moment but the best makers give:

$$\text{Ratio} = \frac{\text{Engine power}}{\text{Turning moment}} = 4.$$

Screw Gear

To fix the power ratio in this type of gear the following formula is the simplest:

Formula IV.

$$\text{Turning moment, } M_t = \frac{A \times V^2 \times L_1 \times C_1}{L_2} \times T_2 = \text{foot pounds}$$

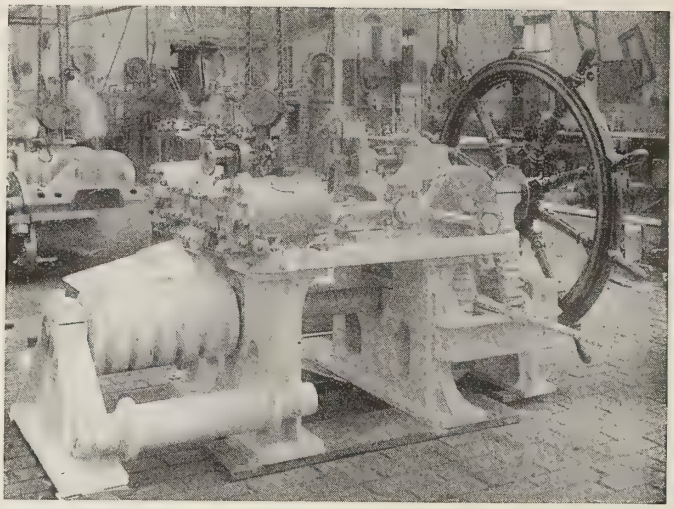


Fig. 1.—Horizontal Type of Steering Engine

where A, V, L_1 and C_1 have the values as in Formula I; T_2 is the travel in feet of the screw gear crosshead; L_2 is the shortest radius, i.e., distance from crosshead pin to center of ship when crosshead is hard over *and engine power* is obtained from Formula III.

taking $R = \frac{T_3 \times N}{p}$

where $p =$ pitch of screw in inches or lead if multiple thread and $T_3 =$ travel of crosshead pin in inches.

Having in a general manner described the methods used to fix the size of steering engines, several of the more important types of the merchant ship pattern will be briefly noted and illustrated.

Horizontal Engine with Chain Barrel

Of the many gears in use the premier position is held for small and medium sized vessels by this style of engine, no

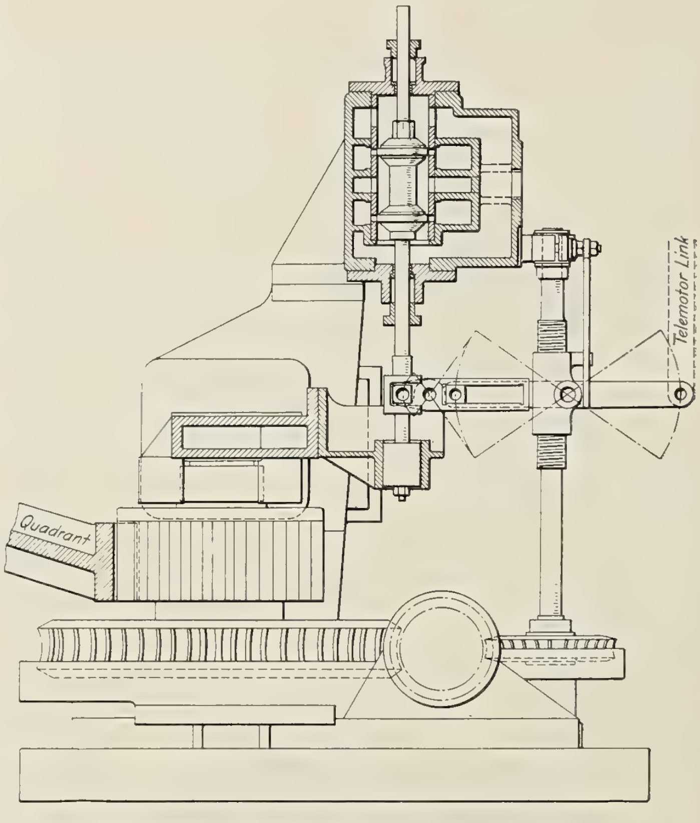


Fig. 2.—Section Through Vertical Quadrant Gear

doubt on account of its simplicity, and the scope it affords for variety of design, combined with the almost unique record it holds for safety, and the ease with which it is manipulated.

Fig. 1 illustrates a steam and hand table or horizontal gear in which the barrel is extended, the shaft being carried by a separate bracket. Guide rollers are provided and the hand gear is supported on an independent bracket firmly secured to the main cheeks by brackets, one of which serves as the fulcrum for the hand lever operating the clutch suitably disposed between the steam and hand gear wheels. As a rule the control for this gear consists of steel shafting with miter wheels and suitable supports. The vertical shaft on the gear will be noted on the illustration.

Vertical Quadrant or "Wilson Pirrie" Gear

This gear has been in favor for many years. It is very rigid and being directly connected to the rudder stock the space occupied is small and there is the advantage that long chain leads are dispensed with. In recent years many improvements for centralizing the rudder and brake gear have been a feature.

Fig. 2 shows a section through this type of gear. On the rudderhead is keyed a toothed quadrant or in the "Wilson Pirrie" type a tiller is keyed to the rudder stock and the quadrant is connected to the tiller by strong eyebolts provided with cushioning springs. The quadrant teeth mesh with a quadrant pinion mounted on a pinion shaft and, in this example, integral with the worm wheel which is rotated by means of a worm cut on the crankshaft of the steering engine.

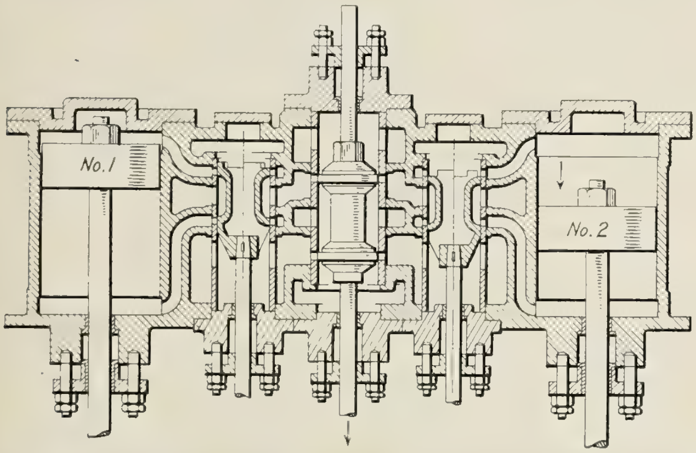


Fig. 3.—Section Through Cylinders of Vertical Steering Gear

It will be noted that telemotor gear control is fitted and a safety device known as the Stanhope lever is used to actuate the control piston, a circular guide taking any strain which might be induced by this lever arrangement. The means provided to return the control piston to its central position are clearly shown and, if taken in conjunction with the cylinder details, the action will be quite easily understood.

Control of the Gear

Fig. 3 is a longitudinal section through the cylinder of a vertical quadrant gear. The control piston is shown in mid position; No. 1 piston is at the top of stroke; No. 2 piston at mid stroke. The eccentrics are set in advance of the crank, therefore No. 1 valve is at mid stroke and No. 2 valve at the bottom of its stroke or travel. If the telemotor link is pushed down with the arrangement in Fig. 2 the control piston moves down causing piston No. 2 to move down, rotating the worm shaft and small worm wheel on the control shaft. This shaft has a screw on which a suitable thread is cut and carries the lever fulcrum nut by means of which the reversing or centralizing of the control piston is effected.

Hydraulic Steering Gear

As there was no reliable controlling mechanism till a few years ago this gear did not receive the attention it deserved, but with the advent of the motorship, owners and shipbuilders desiring to eliminate steam gears have adopted this type.

Fig. 4 shows a modern gear which is a combination, consisting of a constantly running electric motor, driving a variable speed and reversible pump, which delivers oil under pressure to either of two cylinders. These cylinders are fitted with rams having bearings for the journals of a steel crosshead, provided with an aperture to take the circular end of a forged steel tiller securely keyed to the rudder stock. The control for this gear is an adaptation of the telemotor, giving very sensitive governing and great latitude in maneuvering.

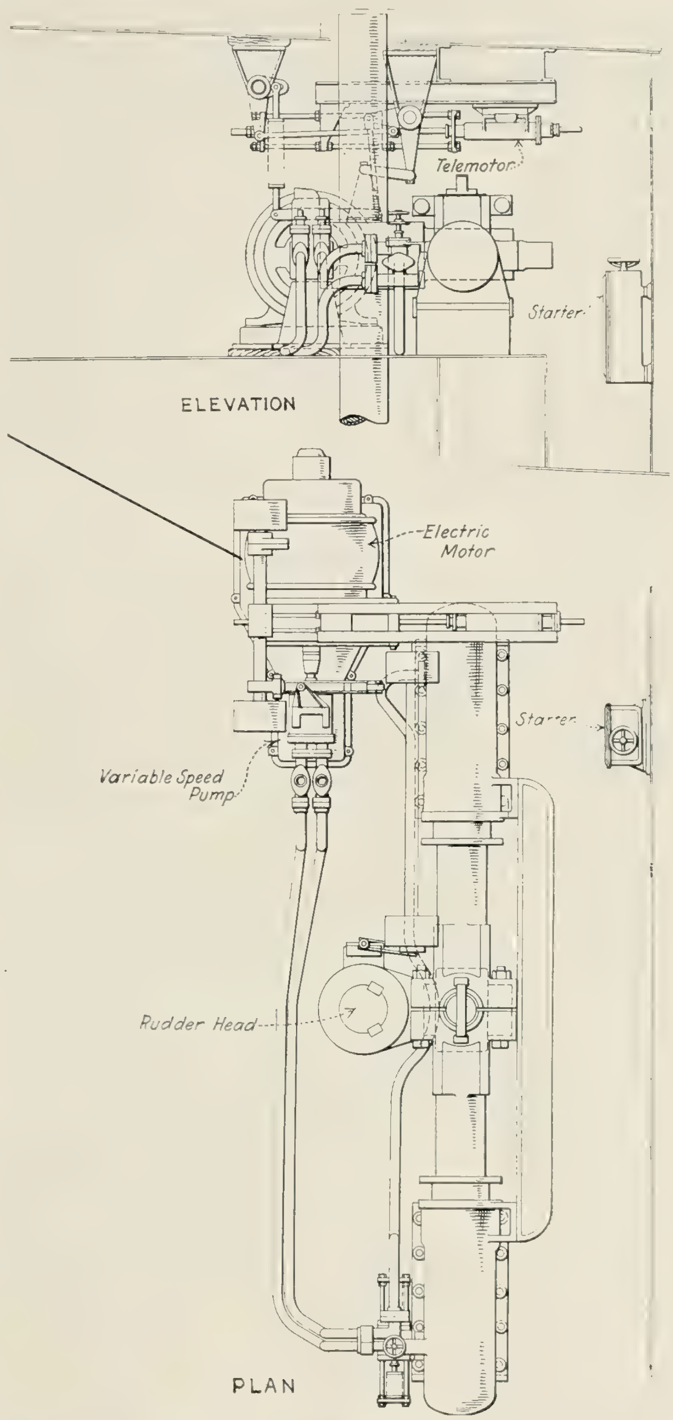


Fig. 4.—Hydraulic Steering Gear

If we suppose the levers in the relay system, which controls the variable speed pump, to be moved down on the left

by the spring link, this sets the pump in motion and transmits oil under pressure to the cylinder and forces the ram to one side. In order to maintain the position assigned to the rudder by the steerer, what is known as a differential gear is fitted. This gear returns the eccentric of the pump to its neutral position, when no oil is transmitted, thus holding the rudder at the proper angle.

Steam Screw Gears

Screw gears operated by hand were among the first styles used. This gear has much to commend it. It is self-holding, is of simple construction, will work well after considerable wear and may be constructed to suit any size and type of vessel.

Fig. 5 shows a well known type of gear for use on a large liner. The screw is placed forward of the rudder stock, strong

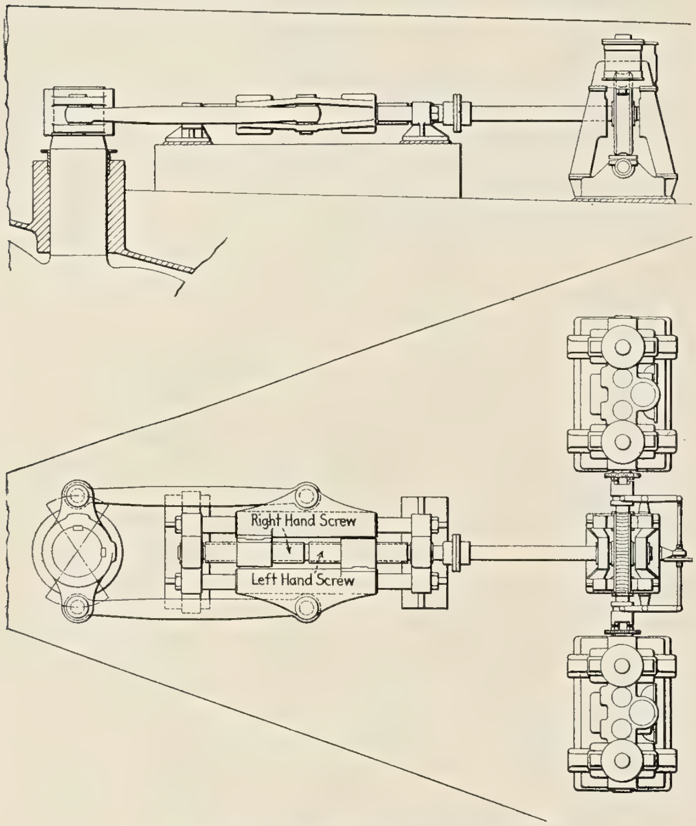


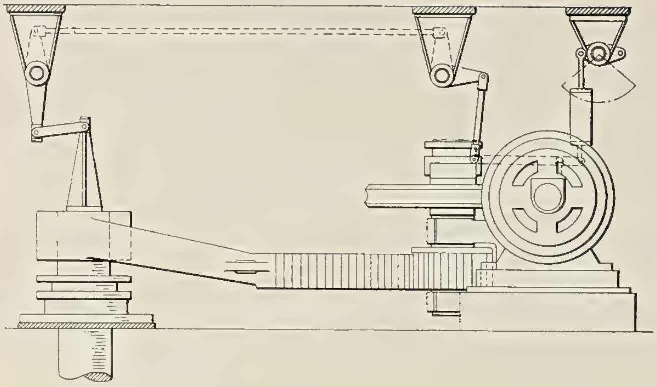
Fig. 5.—Steam Screw Steering Gear

steel connecting rods being attached to a forged steel crosshead keyed to the rudder stock. On an extension of the screw shaft is fitted a worm wheel which gears with a worm driven by the steering engines. The engines are of the marine pattern. One engine acts as a standby. A clutch gear is arranged so that as one engine is disengaged the other is coupled to the worm shaft.

Naval Gear

In British naval practice the most common style is the right and left hand screw gear placed in a compartment near the rudder, with a train of cast steel spur wheels as the reduction gear between the line shaft from the steering engine (which is usually placed in the engine room) and the screw shaft. Occasionally there are two screw shafts, side by side, one having a right and the other a left hand thread. The nut on either screw shaft is provided with an opening to take one end of the connecting rod, the other end of which fits a similar opening in the forged steel crosshead keyed on the rudder stock.

There is usually an auxiliary means of steering consisting of several large handwheels mounted on a shaft which is clutched to the screw gear simultaneously with the withdrawing of the engine clutch. An alternative gear consisting of a William Janney or Hele-Shaw variable speed hydraulic



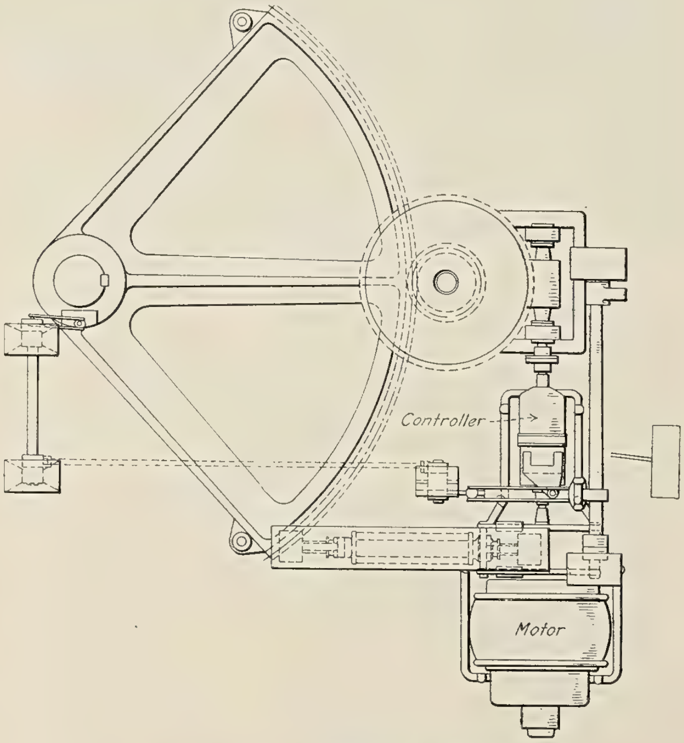


Fig. 6.—Electric Quadrant Steering Gear

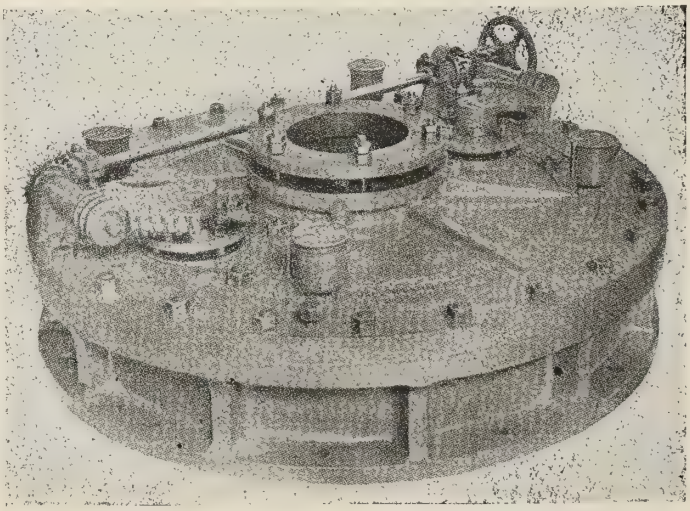


Fig. 7.—Outside View of Rudder Brake

motor with an electric motor as its prime mover is a potent feature of the newest vessels.

Table III. Particulars of Recent Steam Screw Gears

Turning Moment, Foot-Tons	Rudder Stock Diameter, Inches	Diameter of Screw, Inches	Engine Dimensions, Inches	Weight of Engine, Pounds	Weight of Screw Gear, Pounds
20	7	4½	5–5 / 5	1,120	3,136
60	9	5½	7–7 / 6	2,016	3,584
100	11	6½	8–8 / 9	3,920	4,480
200	15½	7½	10–10 / 12	6,384	8,960
240	17	8½	11–11 / 12	6,720	12,320
375	20	10¾	13–13–13 / 13	16,800	22,400
500	26	2–10¾	14–14 / 14	16,240	23,520 (each)
600	28	13	17–17–17 / 14	22,400	40,320

Electric Quadrant Gear

In the American Navy a modern adaptation of the quadrant gear has come into favor, as illustrated by Fig. 6. It consists of a toothed quadrant forced on the rudder stock, the

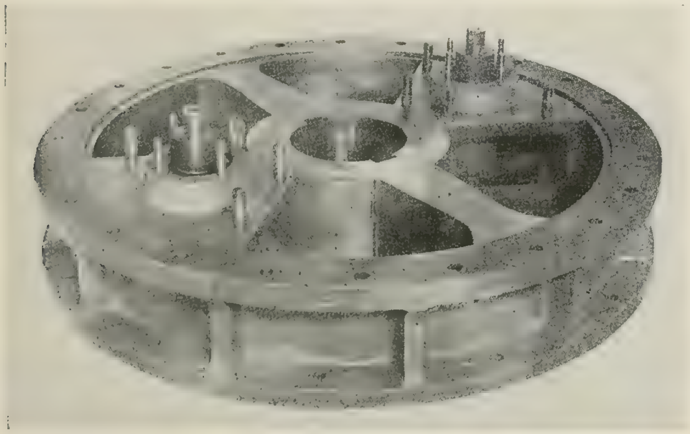


Fig. 8.—View of Rudder Brake With Cover Removed

quadrant meshing with a pinion attached to a pinion shaft. On the opposite end of this shaft a worm wheel is freely mounted but capable of becoming integral for rotating the shaft by a strong clutch. The worm wheel receives its motion by gearing with a worm operated by a variable speed motor or reversible electric motor, the starter for which is controlled by a relay system in much the same manner as the mechanism described in the paragraph dealing with "hydraulic gears."

Rudder Brakes

In self-holding steering gears such as screw gears, also in gears of the hydraulic ram type, it is not essential to introduce a brake but with other designs the importance of a good brake cannot be underestimated. A primitive form consists of a grooved metal segment attached to a tiller and a hard wood block which is forced against the segment by a long lever operated by a screw and nut.

There is also a form of brake similar to that used as buffers on the railway termini, having two hydraulic cylinders fitted with pistons, the outer ends of the piston rods being attached by pins to a crosshead on the rudder stock.

A very good example of the rotary pattern is shown in Figs. 7 and 8. The apparatus consists of a rotary piston keyed to the rudder stock and well fitted to a casing surrounding the stock, the casing having a strong flange bolted to the deck. There are four compartments filled with liquid. Ported segments with cocks and passages give access from one compartment to the other compartment situated on the same side of the rotary piston. In operation with the cocks open the rotary piston simply forces the liquid from one compartment into its neighbor, but when it is desired to cushion the rudder the cocks are partly or fully closed at will without interfering with any other part of the steering machinery.

The piston floats in oil which prevents excess of wear and the rudder and stock may be supported solely by the casing for hung rudders in ships having sterns of the cruiser type.

Portable Electric Rivet Heating Devices

Electric rivet heaters in general embody advantages of cleanliness, ready movement from place to place in the shop and rapidity of heating. The United States Electric Company, New London, Conn., appreciating the

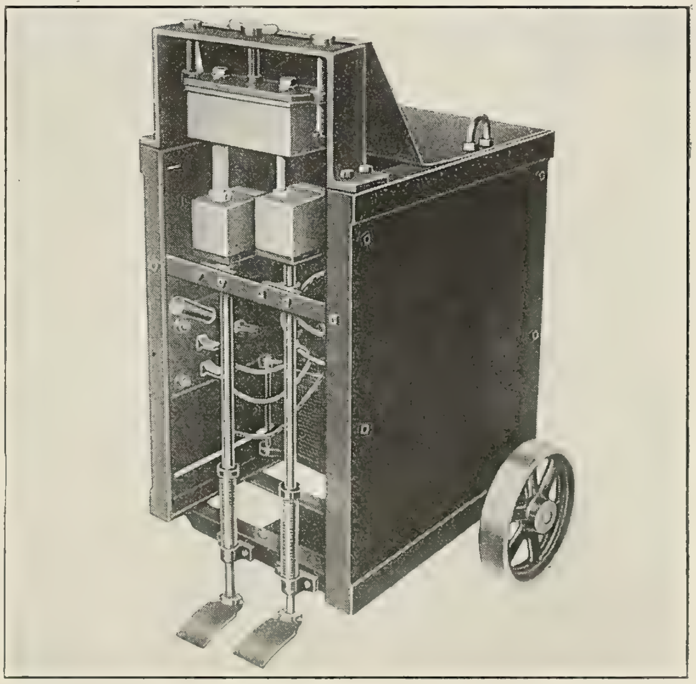


Fig. 1.—Rivet Heater, with Capacity for ¼-Inch to 1½-Inch Diameter Rivets

need for this equipment in boiler, railroad, and structural working shops has developed the rivet heating devices illustrated.

The heater shown in Fig. 1 has a capacity of rivets from ¼ inch to 1½ inches in diameter by 6 inches long. The time required for heating a rivet of the largest size is about 30 seconds.

The device is built in three types A, B and C with electrodes arranged to heat two, four or six rivets at one time. The large type C machine can heat twelve pin rivets per minute, which is as fast as they will ordinarily be required. Ten, 15 and 20 kilowatts, respectively, is the power consumption of the machines, depending upon the diameter of rivets to be heated.

A pan is supplied with the heater when it is desired to

hold a quantity of rivets in front of the operator or heater, and the rivets are easily placed by hand in the electrodes and removed with the tongs when heated. The operation is simple. The control switch being set for the size of rivets to be heated, the operator presses down on the foot lever and places a rivet between the electrodes until the desired heat is obtained. By heating in series after the first two rivets are heated, there is always a hot rivet ready for the riveter, and the operator always can control the current by removing one rivet, eliminating the pulling of a switch. The switch will be supplied if specified so that it will not be necessary to remove the rivet. The machine operates on 60 cycles and 220, 440 or 550 volts, single phase.

The automatic rivet heater, illustrated in Fig. 2, is built to heat rivets when making long runs on one size of rivet, heat-

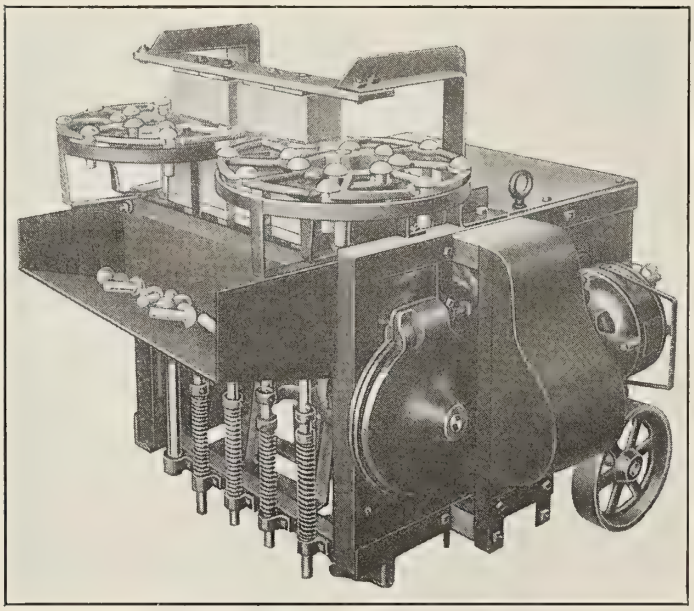


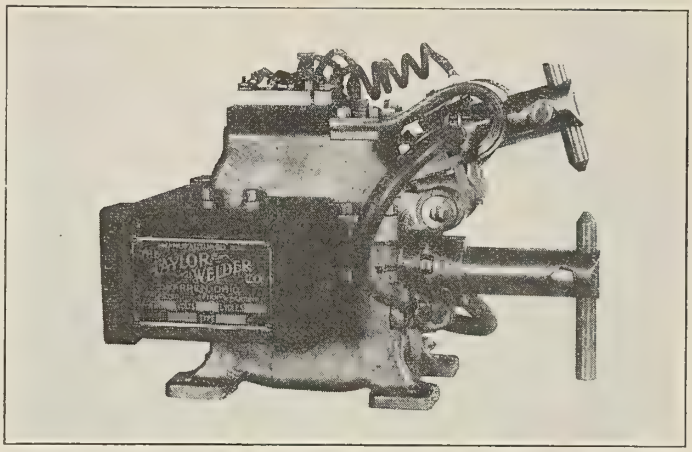
Fig. 2.—Automatic Electric Rivet Heater for Use When Making Long Runs on One Size of Rivet

ing as high as 12 ¾-inch by 2½-inch rivets per minute. The machine is equipped with a control switch, the disks being arranged to hold any size rivet and accommodating 32 at one loading. The electrodes can be adjusted for any length of rivet up to five inches long and timed to give the desired heat in the rivet.

Bench Type Spot Welder

A NEW spot welding machine of the bench type, having a capacity of two pieces of No. 30 to No. 16 gage sheet metal, has recently been put on the market by the Taylor Welder Company of Warren, Ohio. The machine has a cast copper frame which acts as a secondary and adds to its efficiency. Two horns of cold drawn copper 1¼ inch in diameter protrude from the machine, the upper horn being capable of movement through a distance of one inch. The lower horn is made adjustable by drilling three sets of holes in the base and setting the horn to suit the work, a long electrode being furnished to meet this condition.

With the lower horn in its highest position the distance between the two horns is three inches. This distance can be increased to five inches when the lower horn is in its lowest position. The transformer has a capacity of 3 kilowatts and a 4-step regulator is used for adjusting the current. Cooling is effected by the circulation of water through both the upper and lower horns. The floor space occupied by the machine is 10 inches by 17 inches and the extreme height from the bench is 12 inches. An automatic single pole switch closes the circuit and the upper horn and contact point is brought



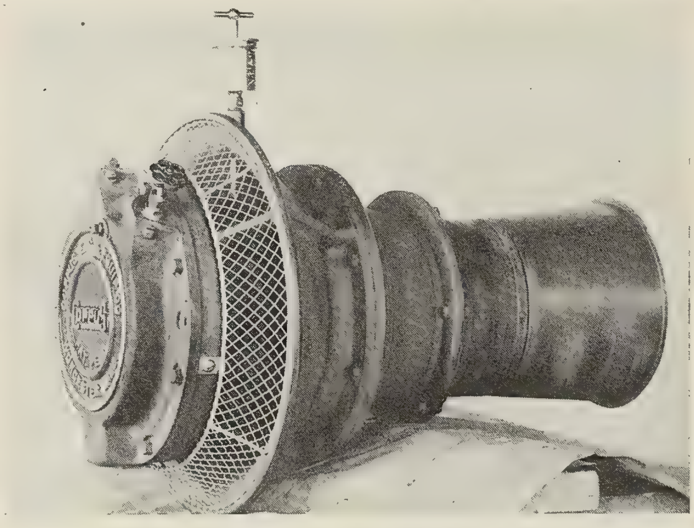
Bench Spot Welder with Water Cooled Welding Horns

against the work by the operation of a foot pedal, not shown in the illustration. The approximate weight of the machine is 150 pounds.

Blower for Forced Draft or Ventilating Service

SCREW blade propeller blowers which deliver air in lines parallel to the axis of the machine have been added to the line of blowers manufactured by the Coppus Engineering and Equipment Company, Worcester, Mass. The Coppus "Vano" blower is designed in two types for turbine and electric drive.

The principal feature of this blower is a stationary guide vane of special design located beyond the propeller. The individual guide vane blades subdivide the air current leaving the propeller radially. These blades, which have a curvature increasing in the direction of rotation of the propeller, concentrate the air current and give it an added



Turbine Drive Blower

acceleration inside the stationary guide vane so that a considerable part of the air pressure is produced in the vane. Much of the end thrust is thus taken up by the stationary guide vane casing.

Because of kinetic energy, the streams into which the flow of air has been divided by the guide vane blades rotate slightly and converge towards the axis as they leave the casing, so that the entire air flow is impelled beyond the guide vane.

The blowers are used for undergrate or forced draft service in hand fired boilers and also for ventilating purposes.

Cost Accounting and Estimating*

By H. H. Schulze†

Cost accounting and estimating are so closely allied that it is not possible to treat of one without the other. In early days, cost accounting as applied to ship work did not receive careful thought or attention but was considered more in the nature of clerical work; during later years, and especially since the cost plus form of contract came into being, cost accounting has become better understood and is today considered among the most important departments of the shipbuilding business. Cost estimating occupied much the same position as cost accounting, and few shipyards reduced their cost estimating to a systematic basis. It is therefore the intention of this paper to treat mainly of the second portion of the title and to describe the methods adopted in the effort to obtain uniform results.

THERE are really three main functions of cost accounting: First, for determining the profit; second, for submitting statements during construction to the operating manager, so that he can anticipate or investigate the overrunning of estimated costs; third, for estimating—that is, to determine the basis upon which to submit bids for similar work. The financial statements required for each of the above purposes are entirely unlike.

For determining profit but one figure is required, namely, the completed cost; for use of the operating manager the statement should be divided into groups corresponding with the division of his operating departments; for determining the cost for future work the statements should be divided by groups represented by physical quantities so that unit rates can be determined, to be applied to similar physical quantities calculated for the proposed work. A good accounting system should provide means to indicate all the above.

The number of groups in the accounting system depends largely upon the variety of work constructed. It is understood that, should but one type of commodity be constructed in which the relation of each operation to the other is always constant, but one factor would be necessary to determine the rates for similar commodities. In ship work, however, because of the varying relations of the many items and trades entering into the numerous types of vessels, it becomes necessary to subdivide the return cost into the correspondingly numerous items, which broadly may be classified in groups of hull and machinery.

The hull is usually divided into general items such as bonds, insurance, watching, temporary electric service, plans, trials and delivery; steel hull, including loft work, staging, launching, hull castings and forgings, and structural hull; woodwork, including joiner and carpenter work; also painting, hull piping, ventilation, electric work, steering gear, warping gear, boat gear, doors and hatches, airports, inside and outside fittings, handrails, deck covering, masts and rigging, and outfit. In naval work there must be such additional items as ammunition handling, turrets, installation of ordnance and armor.

The machinery is generally divided into main engine, condenser, pumps, boilers, stacks and uptakes, forced draft system, fuel oil system, piping, lagging, shafting, bearings, propellers, floors and gratings, tanks, and auxiliaries, including feed heaters, evaporators, distillers, oil coolers, auxiliary condensers, refrigerating, heating, fire extinguishing and disinfecting plants, together with tools and spares.

The above groups are more or less subdivided, according to the nature of the work constructed at the particular plant.

The return cost for each of the above items should be given in the three divisions: material, labor, operating expense, termed overhead.

Material is comprised of purchased material, *i. e.,* items requisitioned and purchased directly for a particular ship; and storehouse material, *i. e.,* material drawn from the general storehouse and applied directly to the vessel. The latter consists of such items as standard pipe, fittings, bolts, nuts, etc.

Labor, sometimes termed direct labor, is that portion of the labor which is charged directly to the vessel.

Operating expense, or overhead, consists of both material and labor and constitutes just as much a part of the cost as either the direct labor or material. It consists of material and labor which is more accurately distributed by prorating than by the direct charge.

The division between direct labor and indirect labor is by no means uniform at all plants. The general principle which determines the division is that direct labor should include all labor where little or no judgment is necessary by the operator in the division of his time. Where it becomes necessary for the foreman or quarterman to estimate the division of his time between the several vessels or jobs, such labor should be classified as indirect labor. An ideal system would be one where all the labor could be accurately distributed directly to its appropriate job. Unfortunately, much of the labor entering into ship construction cannot be charged direct without the arbitrary distribution by the employee, and it must therefore be included in the operating expense.

The material charges in the operating expense embrace such items as light, heat, coal, water, etc., and the labor includes the compensation of foremen, leading men, inspectors, clerks, messengers, cleaners, timetakers, etc. In addition to the above there is included, as administration, selling and general expense, a proportionate part of the cost of the office of the manager, sales department, treasurer, accounting department, purchasing department, plant engineers, service department, etc.

The distribution of the overhead in some businesses can be apportioned according to the units manufactured, where such units are all the same character, but in shipbuilding it has generally been customary to apportion the indirect expense as a percentage of the direct labor. Each department in the shipyard should have an account to which the expense of the department is charged, so that it may be possible each month to prorate the expense of that department among all of the direct labor which it performed for that period.

Since the distribution between the direct and indirect labor is not uniform at various shipyards, it can be seen that direct costs of one yard are not comparable with another yard. To make a proper comparison, it would be necessary to adopt not only a uniform cost system, but a uniform force report so that the distribution between the direct and indirect labor would be the same at all shipyards.

Cost estimates are prepared primarily to form the basis

*Paper read before the Society of Naval Architects and Marine Engineers, New York, November 18, 1921.
†Bethlehem Shipbuilding Corporation, Ltd.

of a bid or a selling price, and secondarily for the information of the general manager so that he may be advised what allowance has been made to each department so as to assist in the reduction of operating costs. The importance of the latter function is being recognized more and more, and an excellent paper on this subject, entitled, "How the Cost System Assists the Management in the Reduction of Operating Costs," was presented by Mr. William B. Ferguson, assistant to the president, Hog Island, before the Society of Industrial Engineers, on March 26, 1920.

Estimating

While the selling price is determined by the amount the consumer is willing to pay and the manufacturer willing to accept, few lump-sum contracts are taken without some form of estimate. The acceptance of a contract on a competitor's bid involves the dangerous assumption that the competitor has not made an error and that the purchasing power and manufacturing efficiency of both plants are equal.

The builder usually prepares his estimates on the same basis and, after submitting several bids, soon ascertains what allowance must be made over the estimates prepared by him to compete with other bidders. Thus, if he is consistently high, with a constant percentage as margin, he knows that, if he desires to obtain the contract, it is necessary to correspondingly reduce the amount of margin.

All estimating—in fact, the solution of all engineering problems—is performed by comparison. A formula is merely an expression endeavoring to reconcile by functions all the various conditions entering into the problem, and the closer the functions and formula represent the condition the more uniform will be the coefficients in the formula. The personal element in the selection of factors to represent the proposed condition is one of the reasons for erratic results in estimating.

Designing and estimating would be reduced to a more scientific basis if, under the given engineering condition, the same dimensions would be obtained at all times, irrespective of the person who is solving the problem. Again, after the size has been determined, if the same weight and cost would be obtained, then estimating would be reduced to somewhat of an exact science. The solution of this problem has been attempted by the method described herein, and, as far as it has been applied, has been found to be very successful.

There is usually a time limit to every estimate, and the problem is to make the best use of this time. One essential is to proportion the time according to the money value of the item, and another is to avoid repeat operations in every succeeding estimate. For example, it is unwise to devote a large amount of time to the calculation of structural foundations and then hurriedly figure the shell plating, merely because this portion is easy to calculate. Again, it is not desirable to devote a large amount of time to an intricate iron casting and to approximate the weight of a composition casting costing several times as much. Repeat operations are avoided by the standardization of particular items, as will be described below.

A good estimating system should be flexible enough to make the best use of all the particulars specified by the purchaser, and where these particulars are not specified it should provide means for determining the sizes according to the best standard practice.

Since estimating consists largely of a comparison with past practice, it is of importance that items to be compared should be on exactly the same basis; otherwise the estimator must make the proper adjustment in his mind before applying the new rates. In former years, when there was no great fluctuation in the material and labor market, it was sufficient to use the price-per-pound method for both material and labor, making slight modification as found necessary. When large fluctuation in material cost and labor rates occur, the mind cannot readily compensate for the varying rates, and comparisons with previous returned cost and with previous estimated costs become of no practical use; therefore a method should be adopted of placing all estimates on the same basis, viz., uniform base for material and labor rates.

Uniform Base for Material and Labor Rates

By an adoption of a standard schedule of material unit rates for the various commodities, and by reducing labor to hours, estimates can be placed on a uniform basis and would not only be comparable one with the other, but would also be available for use at any period by applying current rates to the quantities and to the labor hours which, combined with the current expense rate, produces an estimate on current rates. The relation of the current estimates to the standard estimate should be very nearly constant for the same period.

It is not alone sufficient that details be calculated accurately, but every estimate should be subjected to a check method to determine whether the total represents a reasonable figure. To accomplish this, resort is made to check summary cards, which indicate the quantities and costs combined in large groups, together with appropriate weight factors, and unit rates of material and labor.

The character of the estimate depends largely upon the character of the inquiry. Frequently inquiries do not give any particulars, and sometimes not even the general dimensions. This probably means that the prospective purchaser is merely feeling the market, and in such cases approximate estimates are prepared in condensed groups, using as a basis the check cards of the nearest similar vessels. In the hands of an expert with good judgment, such check-card estimates will give results which compare quite favorably with the detailed estimates.

While space will not permit describing in detail the method of determining the dimensions of vessels and their horsepowers to fulfil required conditions, it might be briefly stated that recourse is made to design cards bearing lineal ratios, displacement and weight co-efficients, also to the freeboard tables and to model experiments conducted by Admiral Taylor and Constructor McEntee. The freeboard tables have been reduced to curve form, making the determination of depth for any draft, length and extent of erections a very simple operation. By reducing the model results of Taylor's Standard Series to a mechanical operation and plotting curves of the relative performance of known models, the horsepower can be quickly determined, and with a reasonable degree of certainty.

In cases where only the general particulars are given, an estimate is prepared by the condensed groups without going into great details, except for the larger groups, such as structural steel hull.

When complete plans and specifications are submitted, or when it is probable that the prospective purchaser seriously contemplates construction, estimates are prepared in full detail. One of the first steps in preparing such detail estimates is the determination of the sizes of auxiliaries purchased from subcontractors and the submitting of the necessary inquiries. The subcontractor, before he will quote, will require complete information regarding the auxiliary, which necessitates not only the engineering knowledge for determining but also knowledge as to how this material is furnished by the subcontractor. In most cases the time required to prepare the estimate is governed by the time necessary to receive prices from outside contractors. This is particularly true when the auxiliaries are not of their standard manufacture.

Having briefly described the general principles and the several kinds of estimates, a description of the procedure in preparing a detail estimate will now be given.

Preparation of Detail Estimate

In a large company the work of estimating is divided among men who become specialists in their particular line. For instance, it is very desirable to have the quantities for woodwork, both carpenter and joiner, calculated by someone who has had practical experience in this character of work; piping should be determined by an expert piping man. The material is generally calculated in the same units as it is purchased—that is, steel by the pound, lumber by the board foot, floor covering by the square foot, etc.

The costs of construction bonds and insurance depend upon the time of construction and the amount of the contract and are estimated on this basis. The cost of the trial trip and delivery depends upon the horsepower, duration of the trial, size of the vessel and the point of delivery, and where this amounts to a considerable item a detail estimate is prepared, taking into account the consumption of fuel, lubricating oil, stores, number of crew, commissary, transportation charges, compass adjustment, docking, towboat charges, etc. In cases where it does not involve a considerable item the cost is merely based upon similar vessels.

The cost of plans is based upon the number of hours required in the drafting rooms, and it has been found that the best criterion for determining these hours is the total hours of direct labor for constructing the hull and machinery separately. Staging and launching depend upon the size of the vessel and the duration of the construction period, and, based upon these factors and the return cost of similar work, proper allowance is made for these items.

The weight of structural castings and forgings is calculated after the sizes have been determined from the registration rules. Practically all vessels are classified in one of the society rules, such as the American Bureau of Shipping, Lloyds, or Bureau Veritas, and if not classified, the scantling and sizes are usually obtained from the above rules.

Hull

The structural hull is by far the largest item of cost and weight in the vessel, and it is therefore essential that the quantities be determined with the greatest accuracy possible. Coefficient methods have at times been adopted, but the use of such methods is dangerous, particularly in the hands of the inexperienced or when a complete knowledge of their derivation is lacking. Usually the approximate lines are sketched, from which curves of shell expansion, floor areas, areas of bulkheads, decks, and the length of frames and reverse frames are obtained. From the above information and the scantlings obtained from the classification rules, quantities are calculated in detail. The grouping is always done in the same manner so that comparisons can readily be made. This is very essential and applies to other jobs as well.

The steel hull is calculated in three groups, each divided into regular classified subgroups. The first group consists of the continuous running members below the topmost structural deck, namely, transverse framing, longitudinal framing, keel plates, shell plating, inner bottom plating and decks. The second group consists of the other members below the structural decks and includes bilge keel, engine, boiler, and miscellaneous foundations, transverse and longitudinal bulkheads, chain lockers, shaft alleys and miscellaneous trunks and ducts. The third group consists of all the erections above the continuous deck, including structural work for the poop, bridge and forecastle, bulwarks, casings, etc.

The steel has been classified in the above logical groups in order that the result can be checked by coefficients obtained from similar work. The quantities are net weight, calculated in pounds, and are classified as to plates, angles, channels, bulb angles, half rounds, tees, etc. The net quantities are transferred to the cost sheets and due allowance made for wastage, to obtain the gross quantity or amount to be purchased. To these gross quantities current unit rates are applied, obtaining thereby the estimated purchase price of this material.

The labor on steel, as in all the other jobs, is estimated in hours, being based upon the returned hours on similar work; to these hours are applied the current averaged hourly earnings of the particular plant, giving the labor in money value.

Joiner work is calculated in board feet and necessitates a knowledge of the kind of materials and dimensions ordinarily used for carlins, studs, sills, plates, internal and external sheathing, straight and diagonal bulkheads and for the various items of furniture. Hardware, fastenings, glass, etc., are listed and priced, unless the time is insufficient, when they are taken by comparison with other work. As with steel, the quantities of lumber are transferred to the cost sheet, due allowance made for wastage, current unit rates of lumber are applied, giving the estimated cost of this material. The labor in hours is estimated, based upon the corresponding prices per board foot obtained in similar work.

Carpenter work is calculated in the same manner as joiner work, but, in addition to the number of board feet, lineal feet are calculated, since the labor is best applied on the basis of the lineal feet as laid by the carpenters.

The amount of paint is calculated in pounds, based upon the extent of the surface covered, treating separately the underwater body, the ordinary steel work, the joiner work and the varnishing and decorating. While cement amounts to a considerable item in the displacement, it does not involve much cost, and this is usually approximated, taking into consideration the size of the vessel.

The hull piping, including cargo oil mains, fire main, drainage and plumbing, is calculated in detail from a single line sketch plan made to suit the special requirements. The number and weight of flanges, fittings and valves are listed and the pipe is calculated in pounds, separate quotations being received for the plumbing fixtures themselves.

A similar procedure is followed in ventilation where this is an elaborate system; otherwise, the ordinary engine fireroom and hold ventilators are obtained by applying quantities derived from similar work. The costs of doors, hatches, airports, hand rails and deck coverings are obtained by counting, or calculating the number and size from the plans, and applying to the quantities, so obtained, prices and weights derived from similar work. After applying to such systems as steering gear, warping gear, anchor gear, boat gear, etc., the prices of auxiliaries received from the subcontractors, the remaining items are estimated by comparison with similar work. Masts, spars and rigging are calculated in detail—that is, the number of pounds of structural steel, the number, diameter and length of booms, the lineal feet of wire rope, the pounds of running rigging and the number and size of various blocks required.

The galley and deck outfit in some cases is very elaborate, and complete schedules are often forwarded to subcontractors for silverware, glassware, linen, bedding, etc., and these prices are applied.

Machinery

The machinery quantities are figured in detail and in the same units as the material is purchased. Within the time limit it is of course impossible to calculate the weights of each casting, such as cylinders, columns, bedplates, condenser heads, etc.; and in some shipyards the weights of such items are derived from an empirical formula, applying coefficients from the nearest similar work. For those shipyards which have a sufficient staff to enable weights and quantities to be classified and standardized, excellent results are obtained

with a minimum amount of time. Curves are developed for the various types of cylinders giving the weights for any diameter and stroke, one series for high pressure cylinders with piston valves; another series for intermediate pressure cylinders with one piston valve, with two piston valves, and with slide valves; and a similar series for low pressure cylinders with various types of valves. Similar curves are developed for all parts of the main engine, including bedplates, bearings, columns, guides, all items of the reciprocating group, the valve gear, etc., so that it is possible without detailed calculations to obtain the weights which meet the required engineering conditions. This same procedure can be adopted for all portions of the machinery estimates, including condensers, boilers, stacks and uptakes, shafting, bearings, etc.

One of the largest and the most difficult items in steam engineering is the steam engineering piping. The best procedure for calculating steam piping is to make a quick layout of the machinery with a single line sketch plan of the various piping systems, including main and auxiliary steam, main and auxiliary exhaust, suction and discharge piping, and to calculate from this layout all the valves, flanges, pipe and fittings in the same manner as for hull piping. Where the time limit will not permit of such detailed layout, piping is estimated in separate groups, as described above, by comparison with the nearest similar job; but here again great care must be exercised, since the several owners' requirements vary to such extent. One company might require copper pipe and composition valves for the system, whereas ordinary good practice would consist of wrought-iron pipe with cast-iron valves; and realizing that the former would cost several times as much as the latter it will be at once seen that the greatest care must be exercised in making assumptions in this group. The deck steam pipes, smothering pipes and heater coils for oil steamers sometimes consist of very large quantities, and, being comparatively simple, they are calculated separately.

Auxiliaries

The specifications cannot specify all sizes, dimensions and character of material, and therefore the estimator must have a complete knowledge of the character of the material and the size required for any portion of the machinery; for instance, in piping, it will be necessary for the estimator to know what connections are made to the various pumps, their size and character of piping. If the sizes of the condenser, air pump, and circulating pump are not specified, it will be necessary for him to know the best practice to determine these sizes. In reciprocating pumps he is required to know not only the size of the pumps, but whether they would be composition end, composition fitted, or with cast-iron cylinders—whether or not soft packing or metallic packing is required. The same detailed knowledge is required for determining all sizes and dimensions where not definitely specified. Having determined the net quantities, they are transferred to the cost sheet; due allowance for wastage, current unit rates are applied, obtaining the estimated cost of the material.

The labor, as with the hull, is estimated in hours, and in most of the groups is based upon the weight, though in some cases better results are obtained by applying unit rates, following the method of manufacture. Thus it has been found that in a condenser it is better to base the hours upon the number of tubes.

A summary of the hull and machinery is prepared from these detailed figures, and on this sheet is applied the current rate of expense. This is not constant for hull and machinery nor even for the separate jobs, since the expense rate of the various departments differ greatly, as described above.

The sum, then, of the material, labor and expense for the hull and machinery gives the estimated cost of the vessel. Throughout the process of estimating, check methods are continually applied, so that there is little possibility of a large error appearing in the process.

Standardization

To avoid repeat operations and to obtain uniform results, the various groups should be standardized. The general method of standardizing a group is, first, to ascertain the theoretical calculation by which sizes are determined; second, tabulate from practice the various sizes; third, apply the theoretical calculations and from practice obtain the coefficient so that the result may coincide with those usually adopted; fourth, calculate and tabulate results throughout the entire range of requirements. A few examples are as follows:

The size of the circulating pump depends upon the amount of steam to be condensed, the temperature of the sea water, the vacuum, and the percentage of the rated capacity of the pump in actual service. After having determined the amount of steam used by the various types of engines, the amount of water required by the theoretical calculation is determined and this amount compared with the rated capacity of the pump indicating that, in normal running condition, the pump is working at a certain percentage of its rated capacity. Tabular statements are then prepared for several temperatures of sea water and for predetermined water rates and vacuums for the several types of engines. Without calculation it is then possible to ascertain from this tabulation the normal size of a circulating pump for compound, triple, quadruple, turbine or electric drive, for several temperatures of sea water, the instructions giving the temperature to be used for the various routes.

The same method applies equally well to the hull jobs. In anchor gear, for instance, the size of the hawse pipe must be sufficient to prevent the chain shackles from fouling under all conditions. From practice, the clearance over the diagonal length of the chain shackle is plotted, to which is added the diagonal length of the shackle for determining the diameter of the hawse pipe. The length of the hawse pipe must be sufficient to permit of the proper housing of the stockless anchor. The top and bottom thicknesses and the dimensions of the lips are plotted from practice. With the standardized dimensions, hawse pipes are determined for all sizes of chains and the weights calculated. The dimensions of chain pipes, devil claws, cable clenches, hawse pipe covers and anchor davits are similarly determined and placed in tabular form. The weights and costs throughout the entire range are carefully calculated and tabulated, so that for any size vessel or any size chain the weights and standard costs of not only the above fittings but the windlasses, anchors and chains themselves can be immediately obtained either in detail or in total.

Application of Standardized Information

A brief description of the method of applying the standardized information is given by an example for determining the size of the main engine when not specified. A tabular statement is prepared, giving the minimum, normal and maximum horsepower; the size of the engine; the minimum, normal and maximum revolutions; together with reference plans, hull numbers, and condition of patterns for the various engines constructed, with intermediate sizes where the sizes constructed are not sufficient to cover the entire range of horsepowers. Based on propeller performance, a tabular statement is prepared, giving the normal revolutions for varying speeds and drafts. Following the direction of the typewritten instructions, it is merely necessary to ascertain from the latter table the normal revolutions for any given draft and speed, and from the tabular state-

ment of engines pick out the proper size. Reference is then made to a weight and cost folder for this particular size of engine, from which can be obtained at once the total net weight, the total gross weight, the standard cost of material and hours of labor. Current cost is obtained from the above by factors.

Similarly, the proper size of the condenser may be determined, and reference is made to the weight and cost folder which contains a list of condensers advanced by intervals of 100 square feet. This is accomplished by increasing or decreasing the length of the condensers actually constructed. The weights and costs are carefully calculated from bills of material, actual casting weights being used for gross weights and scale or calculated weights for net weights.

The principal weight factors for propellers are the diameter of the tail shaft, diameter of propeller, and area of developed surface. In determining the developed surface, the indicated thrust-per-square-inch method was adopted, using the information as published by Admiral Dyson, together with the actual practice used on merchant ships.

Similar methods can be applied to nearly all other jobs, such as forced draft systems, boilers, stacks, uptakes, lagging, shafting, auxiliary condensers, feed water heaters, refrigerating plants, and even tools, instruments and spares.

While the machinery jobs lend themselves better to standardization, similar methods may be applied to the hull jobs, and a few of these will be described.

The determination of the weight of the structural hull resolves itself into two operations: First, the determination of surfaces and lengths according to the dimensions and model; second, the determination of unit weights for those surfaces and lengths. The surfaces and lineal dimensions can be determined directly from a series of standardized lines somewhat similar to those described in the very instructive paper by Mr. A. J. C. Robertson, appearing in Transactions of 1920. These standardized lines were developed by making use of the experiments of Naval Constructor McEntee appearing in the Transactions for the year 1919, and also from the various other model experiments. Investigations were also made regarding wetted surface formulæ in order that the wetted surface for any particular model could be quickly and accurately determined. Taylor's formula was adopted as being the simplest formula, the accuracy being dependent only upon the accuracy of the coefficient. A series of curves of coefficients has been developed so that for any length, for any breadth, for any draft, and for any block coefficient, the surface coefficient could be obtained within the desired degree of accuracy.

The results of the standardization of lines have been incorporated in a folder with typewritten instructions so that a complete set of lines can be at once drawn up for any condition without fairing, or that a particular cross section can be obtained without the use of a set of lines; also, that the areas of any particular cross section to any height and the girths of any cross section to any height can be obtained without the necessity of drawing lines or that the entire surface can be obtained by a simple calculation.

The unit weights are established by the classification society under which the vessel is constructed, and tables of coefficients have been established for laps, rivets, etc.

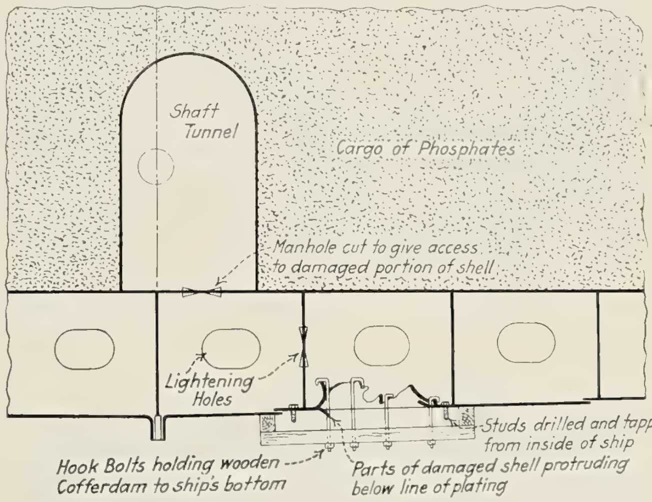
In joiner work standard drawings are made for the various items of portable furniture, such as berths, lockers, transoms, etc., and the number of board feet of lumber of various kinds, together with the amount of hardware for each of these items have been tabulated. The various kinds of bulkheads and joiner decks have been standardized for dimensions and the quantities reduced to lineal or square foot basis. The quantities for complete pilot houses and rooms for the various officers have been tabulated, so that it is unnecessary to make these detailed calculations for each estimate.

The work of standardization is performed during the intervals between estimates, and, when once started, the time saved on jobs already standardized can be utilized for further standardization. It is believed that the time-saving element and the uniformity and accuracy of results well warrant the labor expended; certainly, after the standardization is complete, the time required to prepare an accurate estimate is very much reduced.

A Difficult Submerged Repair Job Accomplished

By A. C. Waters*

THE Japanese steamer *Tamon Maru VIII,* which recently bunkered at Newcastle, Australia, had the misfortune when about to leave port to rip a hole in the bottom of her after ballast tank on a submerged anchor. The *Tamon Maru VIII* is a vessel of 2,977 gross tons, 327 feet long, 41 feet beam and 26 feet depth, and at the time



Sketch Showing Extent of Damage to Bottom of S. S. Tamon Maru VIII

was carrying a full cargo of phosphates. The extreme dimensions of the hole were approximately 4 feet 6 inches square.

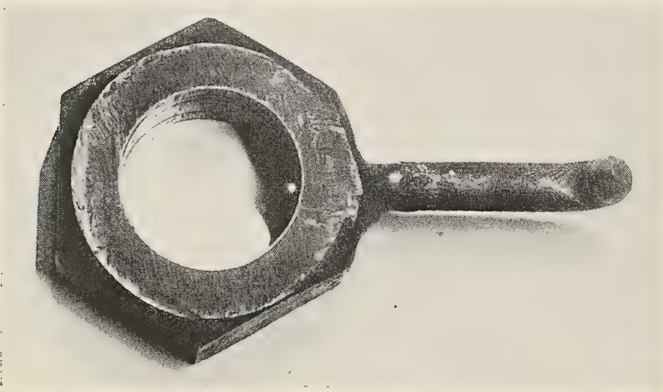
There is no dry dock at Newcastle, and, even if there had been, it would probably have been necessary to unload at least a portion of the cargo, which would have been ex-

*Shipyard manager, Government Dockyard, Newcastle, Australia, N. S. W.

View of Cofferdam on Deck

pensive quite apart from the fact that available wharfage space would have been difficult to find.

It was therefore decided to make the repairs while the vessel lay alongside the dolphin, and the Government Dockyard at Newcastle was invited to undertake the job. The work was started September 23 and the vessel was able to

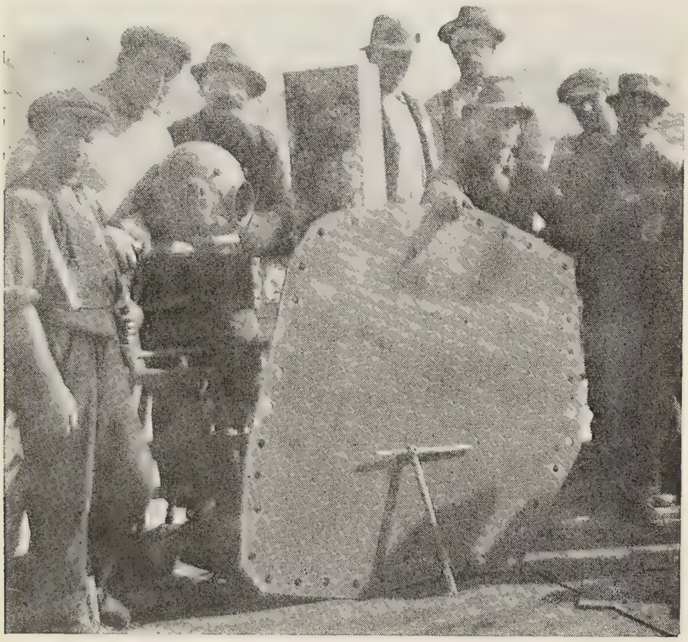


Clearance Nut for Locating Position of Stud Holes

leave port October 1, carrying Lloyd's certificate permitting her to travel to any part of the world.

The work was accomplished as follows:

A large heavy cofferdam, about 6 feet square, was first secured by hook bolts to the damaged portion of the shell by the diver. The after ballast tank was then pumped out, after which a temporary manhole was cut through the tank top in the tunnel, as the regular manhole entrance in the hold was covered with tons of cargo. The work of taking away the damaged portion of the plate, and tapping and fitting of ⅞-inch studs was all done inside the ballast tank



View of Patch Used to Repair Bottom

and within the boundary of this cofferdam; a risky performance, but the good job made by the diver allowed only a little water to enter the tank.

When all these studs were in place and the patch was taken account of from the inside, the manhole cover was secured in position and the diver sent down to demolish the cofferdam. A template prepared in accordance with the information taken from the inside of the vessel was then sent down with the diver. The holes in the template were large enough to easily fit over the ends of the studs. A clearance nut, as shown in Fig. 3, was given the diver and, by describing circles with this nut about the ends of the studs, the exact position of the center of each hole was obtained for punching the plate. This system of obtaining the exact position of each hole worked out so well that, although the plate was punched with proper sized holes and first shipped over the two long pilot studs, it went over the remainder of the studs at first trial, and was screwed up by the diver in very short time, the diver taking all he could on the bolts as the outside pressure increased during the pumping out of the tank. The nuts were further secured by upsetting the ends of the studs.

When the tank was pumped out, examination from the inside showed that the patch was absolutely dry, not even showing signs of a weep. The extreme dimensions of the patch were about 4 feet 6 inches by 4 feet, and it was secured to the shell of the vessel by ⅞-inch studs about 4 inches apart. The patch was ½-inch thick, and after inspection was covered by about 4 inches of cement, which thickness existed elsewhere in the tanks.

It might be added that the remaining portion of the damaged plate served as an excellent holding power for the cement, and the whole job is considered as being very strong and effective, Lloyd's surveyor passing same to allow the vessel to steam between any ports without docking.

Oil Tanker Fulgor

THERE was recently launched by the "Cantieri Navali della Spezia," Spezia, Italy, the tanker *Fulgor* built to the order of the Società Marittima "La Columbia," Genoa, Italy. This tanker is intended to carry oil in bulk between the different ports of the North American Atlantic coast, the Mexican Gulf and also the Black Sea ports, supplying Italian and African ports on the Mediterranean coasts.

The principal dimensions of the vessel, built on the Isherwood system, are as follows:

Length between perpendiculars	401 feet 11 inches
Breadth extreme	54 feet 9 inches
Depth molded	31 feet 3 inches
Gross tonnage	about 6,500 tons
Load deadweight	9,000 tons

The propelling machinery, main and donkey boilers and auxiliary machinery have been supplied by Messrs. McKie & Baxter, Govan, Glasgow.

The propelling machinery consists of one set of quadruple expansion engines, balanced on the Schlick-Tweedy system, with cylinders 21 inches, 29½ inches, 43 inches and 62 inches diameter with a stroke of 45 inches designed to develop about 2,000 indicated horsepower to give the vessel a sea speed of 10 knots.

Steam is supplied by three single ended Scotch boilers fitted to burn either coal or oil, with Howdens forced draft and White low pressure oil fuel system. Steam for the deck machinery is supplied by one single ended Scotch boiler also fitted to burn either coal or oil.

The following auxiliaries are provided: one steering gear, by Donkin & Company, Ltd., Newcastle, one windlass with capstan, two winches, two main petroleum pumps, two auxiliary oil fuel transfer pumps, two dynamos, one Hall's refrigerator, two evaporators, one fresh water distiller and all other auxiliaries for the main engine.

A sister ship of the *Fulgor,* named *Vigor,* is also being built at the same yard.

The Shipping Board announced on March 9 that it has fixed a minimum price of $30 a ton for its ships as representing the world market price and has sold a number of ships at this figure.

Deck Coverings—II

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

COMPOSITION deck covering when well made is not subject to as much expansion and contraction as cement deck covering. It is the practice on large surfaces to insert expansion joints about 30 feet apart, filling them with an asphalt of high melting point.

Expansion and Contraction

There are three types of expansion and contraction effects—the first, that due to expansion with heat and contraction with cold, the second, that due to setting reactions, and the third, that due to aging or storing conditions, humidity, etc. The first of these is very small, but expansion and contraction due to the other causes is sometimes comparatively very great and leads to grave trouble in many cases.

The majority of the expansion or contraction effects of composition deck covering usually occur during the period between final set and 24 hours old. Some products show an expansion of .3 percent in this early period and some a contraction of like amount. With the latter cracking is sure to occur and the former will often cause buckling.

All composition deck covering of the usual mix will expand in moist air or when wet, regardless of the type of magnesite used, but it will not always contract in absolutely dry air.

Some magnesites expand when stored in normal air and some contract. Both the chemical composition and the burning temperature influence the expansion and contraction, but this influence has not been clearly defined. It is unfortunate that commercial magnesites vary as much in this respect as they do, for there is little doubt that much of the trouble encountered by deck covering manufacturers is traceable to this cause.

Excessive amounts of chloride increase expansion effects.

As is the case with strength and wearing resistance, the amount of expansion or shrinkage is dependent upon the strength of the chloride solution used. With expanding magnesites the 22-degree solution is the one productive of the best results, while shrinking magnesites admit of greater solution strengths.

Kieselguhr, Celite, precipitated chalk, volcanic ash and other materials which are of an impalpable fineness, when used in place of silex, are almost certain to give a cement having an excessive tendency toward shrinkage and cracking. Such aggregate absorbs a larger volume of solution and this in drying out during setting produces a change in the volume of the mass. This nullifies the value of the increased covering power sought for and made possible by the use of Kieselguhr and similar materials.

Watertightness

Properly made composition deck covering when intact is practically watertight. Tests on a sample one-half inch thick, as reported by one of the leading exponents of this type of decking in the April, 1918, issue of this magazine, showed a water absorption of less than 2 percent of the original weight after the sample had been submerged for four weeks. Although this type of deck covering as at present developed is essentially an interior one and not suitable for continuous wetting, it is important that it allow of frequent washing without disintegration, that it be unaffected by water standing on it for a reasonable length of time and that it shall not allow water to penetrate to the steel deck beneath it.

The principal factor in securing watertight qualities is proper grading. Some commercial products are so porous, due to improperly graded aggregates, as to allow of seepage of water through them.

The use of too great an amount of water absorbent aggregate, such as soft wood sawdust or flour, impairs the watertight properties.

There are various solutions on the market designed for integral waterproofing, which are of some value. They are, however, not necessary for the customary service of a properly made composition deck covering and cannot be expected to make up for the defects of an improperly made one.

Setting Time

Magnesium oxychloride cements are subject to two sets, an initial set and a final set. After the composition deck covering is mixed, dumped upon the deck and leveled off, the workmen have to wait for the initial set to allow them to move about on it without displacing it for the purpose of surface trowelling. When final set takes place no more trowelling can be done and, if it takes place too soon, the surface has to be finished off as well as it can be by the use of wire wool. There should manifestly be a reasonable time, depending upon the size of the job, between the mixing of the materials and the initial set and at least two hours between the initial set and the final set. With a properly made composition both times are ample and there will usually be about six hours between the mixing and final set in the hot summer months, increasing to about 48 hours in cold winter weather. Composition does not freeze at a temperature higher than 50 degrees below zero; so there is no interruption of operations on that score.

The setting time increases rapidly with decrease of temperature below the normal and decreases very materially with increase of temperature above the normal. The Dow Chemical Company has prepared a curve to show directly the setting time of any oxychloride flooring at any temperature, if its setting time at the normal temperature, i. e., 60 to 70 degrees, is known. This curve shows the setting time at 35 degrees temperature to be about 3½ times that at 70 degrees, and the setting time at 100 degrees to be slightly over one-half that at 70 degrees.

The Dow Company has also prepared curves for use in estimating the effect of chloride solution strength on the setting time, provided the setting time with the use of any definite strength of solution is known, other factors remaining the same. These show for deck covering mixtures an increase in the time after mixing the material required for both initial and final set as the chloride solution is increased from 16 to 26 degrees Baumé, and show that the time between the two

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

sets is a minimum with the 20-degree solution, increasing both ways from that point. They have found that the setting time of an oxychloride cement will average 10 percent faster when made up with 18-degree solution and 10 percent slower with a 26-degree solution, than when a 22-degree solution is used.

The initial set is but little affected, though in some cases hastened by damp air, but the final set is slower in such air. Eight samples of flooring mix tested by the Dow Company in 1920 showed an average of only about 12 minutes increase in the interval between initial and final set with moist air as against normal air when mixed with 18-degree magnesium chloride to normal consistency at normal temperature and about 30 minutes increase in the interval between initial and final set with 22-degree solution.

Both initial and final set occur later as the stiffness of the mixture is decreased from the normal value. The writer has no data for deck covering mixtures to show clearly whether the elapsed time between the two settings is increased or decreased as the product is thinned.

The greater the amount of magnesite, the earlier will be the initial and final sets; but no appreciable gain in the interval between the two sets can be obtained by varying either way from the normal amount.

Magnesite that is underburned sets earlier and magnesite that is overburned sets later, in the composition, than the normal. Many commercial magnesites are far too rapid setting for use in hot weather. Twelve samples of a number of different commercial magnesites made up into a deck covering mixed to normal consistency with 22-degree solution were found by the Dow Company to have initial sets in from 1½ to 6¾ hours, final sets in from 3 to 9¼ hours, and differences between initial and final sets of from 1¼ to 2½ hours. These results show the lack of uniformity in commercial magnesite and the necessity for careful physical tests of the magnesite shipments. Specifications calling for a minimum setting time at a particular temperature would be of great value.

Calcium chloride and sulphates as impurities in the magnesium chloride will somewhat increase the time between initial and final set. These with salt constitute the impurities for which the magnesium chloride is usually tested. The salt has no effect on the setting time.

Color

Uniform and permanent colors can be obtained in Venetian red, dark red, brown, tan, yellow, gray green, light gray, dark gray, white and black. The first mentioned is the most usual probably because being the easiest with which to obtain lastingly good results; and it is a good, warm color for shipboard use. Blue is not apt to be permanent, being affected by any weak acid that might come in contact with it; and a true green, unless made with very expensive material, will in time be changed to yellow.

Thorough mixing is of course a factor in color uniformity.

The Dow Company suggests improving the color uniformity by suitably coloring the fibrous aggregate used; but aniline colors are apt to change color when the magnesium chloride solution strikes them and oil colors will gum the fibers together. Perhaps, however, something of this kind can be worked out.

The surfacing tools used sometimes mar the color. Iron trowels are blackened by the chloride solution and frequently smear the surface when first used on later work. Brass and copper trowels produce a green discoloration from the same cause. This trouble may be eliminated by the use of bronze trowels.

Sweating and Efflorescence

Sweating of the composition deck covering results principally from an excess of magnesium chloride solution, which absorbs the moisture from the air. It depends to some extent upon the nature of the magnesite used. Some magnesites are hard and sandy in texture even though finely ground while others are soft and velvety. The former have a tendency to allow the solution to work to the surface during trowelling while the latter hold it uniformly in the mass. An excess of surface chloride combines with the other surface material to form a compound which is very hygroscopic. Underburned magnesites combine with much less chloride than do properly burned magnesites, and may on that account give rise to sweating troubles.

Efflorescence is principally a result of the sodium chloride, or salt, which occurs as an impurity in the magnesium chloride, and less than .2 percent of salt will cause it. It is increased by heat. If it is not washed off as it appears it has a tendency to fade the color of the deck covering. Efflorescence is only a temporary trouble and a flooring that is kept clean soon loses this undesirable property.

Surfacing

The surface finishing of a composition deck covering is a very important factor in a successful installation, and necessitates the maintenance of a field organization of workmen who are skilled in the art.

The use of fine fibers and wood flours is an aid to ease of trowelling and the uniform appearance of the deck covering. The value of trowelling as an aid to wearing qualities and the reduced wear resulting from the use of wood flour instead of sawdust have been previously referred to.

Cork as an aggregate has a tendency to cause roughening and pitting of the surface under traffic. It has been tried out in various forms by some of the deck covering manufacturers, and abandoned.

Imperfect mixing results in surface pitting.

Thickness of Coating

The properties of a composition deck covering, among which are relatively slight toughness and some expansion and contraction, demand a minimum thickness over buttlaps or other high spots of ¾ inch. The thickness of 1½ inches which is usually specified for shipyard work will in most cases allow of this. The average thickness of such a covering will be about 1⅛ inches, and the weight may be approximately figured as 7¾ pounds per square foot.

Specifications

The writer has not seen any specifications for composition deck covering that properly protect the user of it, and this is probably because any batch of material cannot be properly tested out prior to being put down and because the test of a previously prepared sample or of a part of another batch will not give the answer. It is probable that most of the technical points which we have been considering will have to be taken care of by the manufacturers in specifications for the purchase of their materials, and the writer understands that the National Association of Oxychloride Cement Manufacturers is about to undertake the preparation of revised and uniform specifications of this nature. The following requirements can however be very well embodied in specifications for the completed product:

1. The application of an approved bituminous solution directly on the steel.
2. Pure ingredients of the nature required for a magnesium oxychloride cement, properly graded.
3. Uniform and permanent color.
4. Thorough mixing of the ingredients.
5. Use of magnesium chloride solution strength not less than 22 degrees Baumé.
6. A consistency of mix that will support on end a 1-1/4 inch diameter blunt ended rod weighing 250 grams.
7. An approved method of binding the covering to the deck.
8. A normal thickness of 1-1/2 inches or more, as desired, with a minimum thickness at any spot of 3/4 inch.
9. A thoroughly trowelled, smooth surface.
10. A guarantee for one year against excessive wear and cracks.

The guarantee does not protect the ship from loss on account of being delayed while the covering is being renewed, but is of value when furnished by a reliable manufacturer.

Congoleum

See "Felt Base Deck Covering."

Cork Composition Tiling

This is an interior deck covering made of powdered cork, wood flour, linseed oil, gums and pigments, in a manner similar to linoleum and cut into tiles which finish about ¼ inch thick, interlocking or otherwise.

It is quiet, warm, elastic and non-slippery to the tread, has good wearing qualities and allows of pleasing artistic effects. It is used in the same locations as rubber tiling. This tiling ¼ inch thick weighs about 1½ pounds per square foot. It is cheaper and lighter than rubber tiling.

The materials should be clean and pure and thoroughly mixed so that the tile is homogeneous throughout.

The sheets should be seasoned in drying rooms for at least three months before the tiles are cut. The edges should be cut clean and square, and the tile be true to size, as otherwise the covering could not be laid watertight.

The tiles are fastened to the backing with waterproof cement and should be serrated on the under side to insure a proper bond with the backing. They can be laid direct on wood or cement. Steel decks are preferably leveled off with a special cement or composition as Portland cement will crack under this tiling unless it is several inches thick. A coating of bituminous solution under composition is desirable.

Dreadnaught Tiling

See "Cork Composition Tiling."

Duraflex

See "Mastic."

Everlastic Tile Decking

See "Cork Composition Tiling."

Felt Base Deck Covering

This deck covering is a substitute for linoleum. It is proposed by its manufacturers for use in the same locations and is laid in the same manner. It is an asphalt saturated felt base material, and, if a poor asphalt is used, the product will be poor. The following specifications have been prepared by one of the manufacturers as embodying requirements which will ensure good quality.

Base Material and Seasoning. The base of this material is to be manufactured of a good grade of rag stock well beaten and formed into a sheet and then staurated with compound petroleum asphaltum. This saturated sheet shall then be well seasoned before the application of any surfacing material.

Surface Material. The surface of this material shall be manufactured of the best grade of linseed oil, gums, pigments, and colors. It shall be well baked and thoroughly seasoned before inspection and shipment.

Uniformity of Color and Grain. When this material is cleanly cut at an angle of 45 degrees, it shall show no material difference in color or grain between the edges and center in either the base or the surface.

Weight and Thickness. The thickness of the base of this material shall be measured on a spring micrometer thickness gage, and shall gage between 63/1000 inch and 67/1000 inch. The surface of this material shall also be gaged on a spring micrometer thickness gage and same shall gage between 26/1000 inch and 29/1000 inch. This material finished shall weigh five pounds to the square yard and shall have a total thickness of from 90/1000 inch to 96/1000 inch.

Backing. The back of this material shall be well covered with a coating of linseed oil and pigments.

Tests for Quality. This material shall be made to withstand the following tests after it has been kept at a temperature of 70 degrees F. for a sufficient length of time so that the whole body has reached this temperature.

Bending Test. A strip 2 inches wide with backing on inside of curve shall bend, without showing the slightest signs of cracking, around a bar two inches in diameter. At least one strip shall be cut longitudinally and one strip transversely of the roll.

Indentation Test. This is the same as required by the Navy Department for linoleum and given later under that head.

Absorption Test. A sample 6 inches by 3 inches shall be weighed and then submerged for 24 hours in fresh water at a temperature of 70 degrees F. The sample at the end of this period shall be removed from the water and the surfaces, including edges, dried between blotter or filter paper. At the end of 2 minutes from the time the test piece has been removed from the water it shall be weighed again. The increase of weight shall not be more than 5½ percent.

Number of Tests. When inspected at the factory, at least one complete set of tests shall be made on each lot, a lot being defined as material submitted for inspection at one time, made of the same quality and proportions of saturating material and coloring matter, calendered and seasoned at the same time and under the same conditions. In no case, except in the delivery of a single roll, shall less than two sets of tests be made.

Insulite Mineral Rubber Flooring

See "Mastic."

J. M. Asphalt Flooring

See "Bitumen Deck Coverings." Class (b) Trinidad asphalt is used.

Kompolith

See "Composition."

Lead

Sheet lead should be used on wood decks under the entire cement floors of wash rooms and toilets, extending up the side walls about 9 inches above any other deck covering. Sheet lead around a room extending up on the walls in this manner and a short distance out on the floor is called a flashing; and lead flashings should be run generally around toilet and wash rooms which are not tiled, refrigerated rooms and other spaces on the floors of which water is apt to collect. Lead is sometimes used on the floors of wash rooms with no other covering except a wood grating.

Sheet Lead for these purposes should be about ⅛ inch thick, which weighs 7.4 pounds per square foot.

Linoleum

Linoleum is an interior deck covering and the nature and properties of the inlaid, or so called "Battleship," linoleum are similar to those of cork composition tiling. It is of value for the wheel house, chart room, living quarters and passageways. Navy Department specifications for this material embody the following requirements:

Material and Seasoning. To be manufactured from the best grades of linseed oil, driers, gums, cork and coloring matter. An admixture of wood flour is not objectionable, provided that the requirements of these specifications are met. It shall be thoroughly seasoned before being offered for inspection or before being shipped.

Uniformity of Color and Grain. Surface cleanly and freshly cut at an angle of 45 degrees shall show no material difference in color or grain between the outer edges and the center. To be terra-cotta red ground body throughout.

Cork. The cork shall be clean, thoroughly ground, and of such size that when ready for use it will pass through a screen not coarser than 22-mesh.

Burlap Backing. The linoleum compound to be provided with a burlap backing of the best quality of hard-spun yarn weighing not less than 8 ounces or more than 11 ounces per 36 inches by 40 inches. The burlap to be deeply imbedded and keyed to the cork compound so as to be partially concealed in same. The burlap shall not be painted.

Weight and Thickness. Thickness shall be measured over the burlap on a spring micrometer thickness gage. The grades of linoleum shall be known as "Heavy," "Medium" and "Light," and shall conform to the following:

	Thickness in inches		Weight per square yard in pounds
	Minimum	Maximum	Minimum
Heavy	0.243	0.265	9½
Medium	0.185	0.201	7
Light	0.125	0.142	5

Tests For Quality. Linoleum shall withstand the following tests after it has been kept at a temperature of about 70 degrees

F. for a sufficient length of time so that the whole body of the linoleum has reached this temperature.

Bending Test. A strip 2 inches wide with burlap on inside of curve shall bend, without showing the slightest sign of cracking, around a bar 3 inches in diameter for heavy, 2½ inches in diameter for medium and 2 inches in diameter for light weight linoleum. At least one strip shall be cut longitudinally and one transversely of the roll.

Indentation Test. Sample disks, 1 inch in diameter, shall be cut from the delivery and prepared by removing the backing and then buffing so that the under surface is absolutely smooth and parallel to the upper surface. A pressure of 80 pounds shall then be applied to the upper surface of the disks for a period of 60 seconds by means of a flat cylindrical steel bar 0.282 inch in diameter. The bar shall be supported in a frame in such a way as to insure the face of its foot being parallel to the surface of the linoleum. The edges of the face by means of which the pressure is applied shall be buffed smooth to prevent cutting the linoleum. The load shall be lowered gently until its entire weight presses upon the linoleum, but in no case shall the load be dropped upon the linoleum. One hour after the test has been made, the depth of the indentation shall not exceed 0.010 inch. If the depth exceeds this amount, the material shall be rejected. The surface of the material shall show no sign of being broken through or cut and, if such condition exist, even though the depth of the indentation does not exceed 0.010 inch, the material shall be rejected.

Burlap Test. Two-inch strips of linoleum shall be taken, one in the direction of warp and one in the direction of filling, and broken about 1 inch from the end by cutting part way through from the face and bending back. The burlap backing shall then be stripped slowly from the remainder of the test pieces by pulling at right angles to the back. The pull required shall not be less than 6 pounds.

Absorption Test. A sample 6 inches by 3 inches, prepared by removing backing and sandpapering or buffing the rough surface from which the backing is removed until the surface is absolutely smooth, shall be weighed and then submerged for 24 hours in fresh water at a temperature of 70 degrees F. The sample at the end of this period shall be removed from the water and the surfaces, including edges, dried between blotter or filter paper. At the end of 2 minutes from the time the test piece has been removed from the water it shall be weighed again. The increase of weight shall not be more than that indicated in the following table:

Linoleum	Allowable increase of weight
Heavy	3½ percent
Medium	5½ percent
Light	7½ percent

The wear resisting qualities of inlaid linoleum as well as the very inferior nature of painted linoleums are illustrated by the wear resistance table in the section on "Composition."

When laying linoleum all inequalities should be filled up with a special cement and the deck and the underside of the linoleum coated with linoleum cement.

Linotile

See "Cork Composition Tiling."

Linotol

See "Composition."

Litosilo

See "Composition."

Maple

This is an attractive deck covering that is of value on shipboard for public rooms of the nature of social halls. Its good wearing qualities are shown in the table in the section on "Composition."

Maple decking should be quarter sawed, ⅜ inch by 1½ inch, and be laid over a substantial wood deck with a layer of parchment sheathing paper between.

Marbleloid

See "Composition."

Maritimo

See "Bitumen Deck Covering." Special.

Mastic

The name Mastic is usually applied to a deck covering that is made by dissolving Elaterite by a volatile oil in sealed containers and adding asbestos fiber. Elaterite is a mineral rubber found in Utah which is almost pure bitumen and has a melting point of about 300 degrees F. The more volatile the oil the better, hence naptha is generally used. When applied to a deck the naptha evaporates, leaving a firmly adherent coating that contains no material soluble in water or acids, nor anything injurious to steel.

Mastic is resilient, waterproof, sanitary, durable and of light weight. A proper installation will not crack or come loose from the deck plates. If it is scarred or otherwise damaged it is very readily repaired; and holes can be cut in it or work done to steel or woodwork beneath it without injury which cannot readily be made good. Worn spots can be patched and the patches made indistinguishable from the original. It is much preferable to cement for living quarters, such as for the ship's personnel, where the cost of composition might not be warranted. The colors most readily available are black, green and dark red. An effort to obtain other colors would probably be at the expense of some of the good qualities of the coating.

For a substantial coating there should be a minimum thickness of at least ⅛ inch which for best results requires four coats. The naptha will not evaporate properly from a coat much over 1/32 inch thick and an attempt to lay thick coats results in a covering which will harden on the surface and be soft underneath, thus becoming dented and uneven. Inequalities in the surface to be covered, such as plating laps, are taken care of by previously prepared wedges of the material or some other material such as composition which will not crack or have a tendency to creep in hot weather.

This deck covering will weigh from 2 to 3 pounds per square foot, depending upon the inequalities in the surface to be covered.

The chief disadvantage of Mastic is the fire hazard due to the evaporating of the naptha while the material is being laid. A light of any kind or even a hot rivet will start a fire. There is no danger after the covering has hardened. This objection could be overcome by the use of tetrachloride of carbon instead of naptha to dissolve the Elaterite, but that material is very expensive. It can be said in this connection that while some shipyards will not use Mastic on account of the fire hazard, it was used during the rush work of the war on a great many steamships without any fire casualty as far as known to the writer.

In laying Mastic on a steel deck a coat of liquid gum solution is applied, the triangular filling pieces at the laps and butts are laid in it, and the first body coat of Mastic is put on with a trowel in a plastic state and then rolled, without any waiting between these operations. Other body coats and the finish coat are laid on subsequent days, one a day. Sometimes two finish coats are required. The body coats get hard enough to walk on in about 12 hours, and the finish coats, which have the color in them, in about 24 hours, though this depends somewhat upon weather conditions.

Mastic is laid on wood and concrete decks in the same way except for the absence of filling material to level up these decks.

Neuchatel

See "Bitumen Deck Covering," Class (b).

Penco

See "Composition."

Rubber Tiling

This is an ideal deck covering for dining saloons, smoking rooms, lobbies, passageways in passenger accommodations, stair treads and similar service. It has the well known quiet, resilient, non-slippery and waterproof properties of rubber, and admits of artistic design and coloring. The tiles are made interlocking or otherwise, about ⅜ inch thick, and are cemented down. They are usually made up in sections 2½ feet square for convenience in laying, composed of a number

of the tiles locked together in the desired pattern. The backing has been referred to in connection with cork composition tiling.

Rubber tiling is more expensive and heavier than cork composition tiling but on the other hand it is more waterproof and sanitary and has a cleaner appearance. The weight is about 4½ pounds per square foot.

Tenax

See "Bitumen Deck Covering," Class (b).

Tile

The two classes of tile which are of particular interest for shipbuilding purposes are—

(a) Wall tile
(b) Floor tile

Both are usually ceramic, or pottery tile, made of powdered clays which are subjected to great pressure and fired. They are given an uneven back surface for better adhesion to the backing material.

The wall tiles are mostly made of white-burning clays and flint and are porous and of moderate hardness after being burned. These tiles are, however, subsequently dipped in a glazing mixture and fired a second time, which develops a hard, waterproof surface that is very sanitary and easily kept clean.

The floor tiles, with which we are principally concerned, should not be glazed, as that makes them slippery. In addition to being non-slippery they should have good resistance to abrasion and be dense enough to prevent the absorption of dirt and moisture. Vitrified, but unglazed, ceramic tile has these properties and because of this and its harmony with the glazed wall tile it is usually found in the high grade toilet and wash room construction which calls for glazed tile on the walls. It also makes a high grade flooring for cold storage rooms. The color is preferably white or cream. The high wearing value is shown in the table under "Composition."

Encaustic tiles are those which have the main body of one color of clay and patterns laid in other colors of clay before firing. Ceramic tiles are often called mosaic tiles, the latter word having reference to patterns made by the use of tiles of different colors.

Brick tiles have been previously dealt with.

There are various special makes of floor tile, some of which are designed to be particularly non-slippery and wear resistant.

Tiling is laid in Portland cement backing which should have expanded metal or similar reinforcing in it. The cement should be at least 1¼ inch thick and the tiling be laid and grouted just after the cement is laid and before it has reached its initial set.

The Most Interesting Job in the Yard

Another spokesman for the ship designers, or ship draftsmen, has something to say this month as to why their work is the most interesting in the yard. How about YOUR job? How does it compare with the others discussed under the above heading? Tell us about it.

ALL of us who work find, at least spasmodically, something absorbingly interesting in our task but to only a few of us is it given to discover a sustaining interest before we have reached that period in life when we are expecting time to knock at the door and say that our years of usefulness are at an end. At that moment, how many intelligent people are ready to lay down their work? How many of them do not feel that just then they are prepared to accomplish something really worth while? The years that have oozed away were spent in the daily struggle for the daily bread, or wasted in vain pursuits and endeavors, but, now, when old age has robbed them of their strength they eagerly desire to accomplish something more lasting, to do something creative. And never did work seem so alluringly tempting, so intensely interesting as do these creative tasks of the future that must be left to someone else to do or that must go undone.

That is the key to interest in work, the doing of something creative whether it be in the field, in the shop or in the office, and the lack of interest, with the consequent "labor unrest," is usually traceable to the inability of the worker to see the creative value of the task assigned to him. Of all the tasks that are necessary for the creation of any of the multitudes of products of modern industry, those which are most inclusive, which most completely survey the entire process of manufacture or creation, necessarily have the strongest and most lasting hold on the interest. And what task is more inclusive than that of the designer who follows the entire process from the first conception to the last polishing touch of completion? And what designer has a wider, a more inclusive range of interest than the designer of ships—even though he be only a "scrub draftsman" to whom it is given to see, in the plans he handles, the seed of a floating, moving, living ship? To be sure, some people succeed in taking an interest in fields of work where no finished results are ever visible, but I am inclined to believe that their interest is forced, that it is sustained by their determination to shut out from their consciousness every feeling of incompleteness, every suspicion of disappointment or of lagging of interest because the results of their efforts are not satisfying to themselves.

Admittedly, there may be a gambling interest in work—the interest of the financier who plays the game and takes his losses as well as his gains. No doubt there is also a touch of romance in such activities, as, for example, in the financing of the manufacture of a product that is sent over the seven seas to the four corners of the earth. But I sometimes wonder why the really successful financiers so often turn to philanthropy. The moralist may mutter something about the compunctions of conscience, but is it not possible that the building of libraries and colleges and hospitals is at bottom nothing but the fulfillment of a desire to do something more lasting than the hoarding of wealth, to accomplish or take part in something creative, to see something grow—other than the figures on the credit side of the ledger? If this postscript of creative work really is, though perhaps unconsciously, intended to satisfy an inborn desire for useful labor, then the whole of the previous career must be regarded as but a preparation for the creative work and purely financial success is then measurable only by the extent to which it makes creative work possible. But without this long period of preparation, it is possible for all of us to do useful, creative work, work that is necessary for the making of a finished product.

And when the finished product is a ship, with the relative lack of repetition usually met with in ship work, the appeal

is even greater than with most things that ordinarily come under the head of finished products—and all the more so when your share of the building is that of a draftsman. There was the first, rough, preliminary design, perhaps preceded by a study of service conditions. Follows then that fascinating game of give and take, the aim of which is to satisfy all concerned as far as possible, and which is ordinarily known as chosing the lesser of two evils. And that is a game continued until the ship is delivered and you heave a sigh of relief, for way back in the dawn of the history of this contract there was the estimate, which has been hanging over your head like the sword of Damocles, that document of figures covering a score or more of trades in steel work alone, covering steam and electrical engineering, piping and plumbing and wiring, carpentry and joiner work, rigging and equipment, painting and cementing. Although not, to be sure, master of all these trades, the draftsman, when he also officiates as estimator, makes prodigal use of detailed cost figures pertaining to them all, not to mention overhead costs, only to find it a rather painful performance to work within the estimate when the day of reckoning has come.

Not that his life is made up of estimating and days of reckoning only. There are many days of growth, growth of plans and material piles in the yard, growth of the ship's structure from the time the keel blocks are lined up and the keel is laid until the day when the vessel gracefully slides down the ways amid the blowing of whistles—yes, growth even until her rigging is set up and the first smoke is starting to curl up from her stack. Did you ever watch the floors and frames go up from day to day? Did you ever see the shell plating grow and gradually envelop that skeleton we call the framing of the ship, just as the spring foliage gradually envelops the twisted skeletons of trees and shrubs? If you have seen these things, and if you have had any part in the growth of a ship, you know the feeling and the interest that observing this development produces.

And the interest does not end even when the ship, the curl of smoke changed into a long, thin streamer, speeds away from the yard. So long as that ship floats and sails the seas your thoughts are more or less with it—sympathetic thoughts, which make you feel that this thing of steel and iron that you have helped develop from a mere conception is almost a living thing that carries with it something of your personality, for is not part of yourself woven into it?

And again, there is the larger view, the broader interest: each ship you help build becomes a unit of a fleet, be it merchant or naval, destined not merely to do its share of the world's work for the term of its life but also to be a foundation for the ships of the future, for better ships and safer ships, if not for larger ships, and to add its mite to the store of general knowledge and skill that makes the advancement of the world possible.

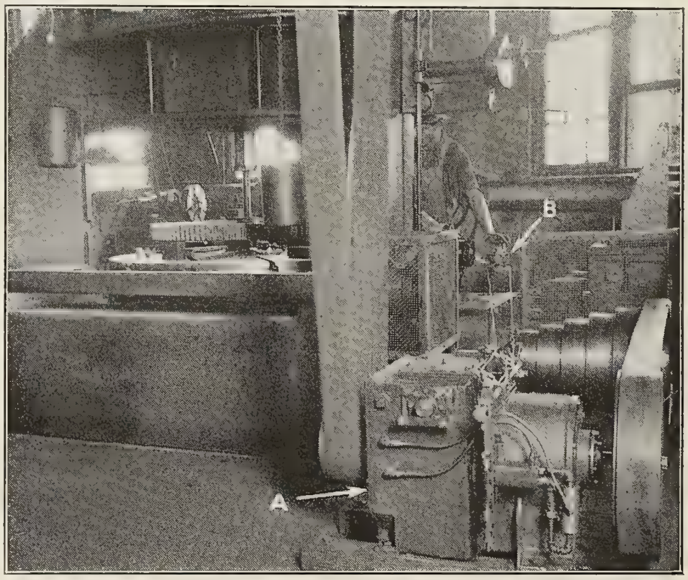
Quincy, Mass. John Flodin.

Oil Pressure Power Transmission Applied to Machine Tool Operation

In applying variable speed, oil pressure, power transmission devices to machine tools the Oilgear Company, Milwaukee, Wis., has developed a feed control and a variable speed drive to eliminate the manual work of controlling medium and heavy machine tools. The feed control system consists essentially of a pump which may be adjusted through a wide range of delivery capacity and a motor driven by the oil received from the pump. The pump is ordinarily driven from the countershaft of the machine tool on which the control is applied and the motor attached to the carriage or ram on which the feed is desired.

Two types of feeding motors are employed: the direct acting pushing cylinder and the rotary motor, the former being used when space conditions permit. For very long machines and frequently for cross feeds where it is necessary to have a screw control of the tool slide, the rotary type of motor is used. A feature of the feed gear, is the rapid traverse movement obtainable which enables the operator to move heavy carriages and rams without fatigue. The feed control permits the operator to increase the feed when cuts become lighter, back out the tool for examination of the cutting edge and return it quickly into the cut without disconnecting the friction clutches, etc.

Delivery of fluid from the feed controller, varied in quantity and direction, compels the feeding motor to perform exactly the function desired by the operator. The pressure in the system is large or small according to the resistance offered to the cutting tool, but the feed motor moves at the exact rate of speed called for by the operator without regard to the pressure required to do the work. If this pressure rises above the maximum necessary for feeding, a relief valve



Rear View of 7-Ft. Boring Mill Equipped with Oilgear Variable Speed Drive

opens and permits the feed motor to come to a standstill. This property is made use of in locating shoulders and the like in work to be machined as it is only necessary to set rigid stops and allow carriage to run against them as desired.

In addition to its use on lathes and the like, the variable delivery pump may be applied to presses and boring mills. An example of this is given in the accompanying illustration, where the device is shown applied to a 7-foot boring mill. This machine is driven by the standard feed controller requiring only a belt drive from a line shaft.

A larger type machine, designed to drive the spindles of machine tools from a line shaft, a constant speed electric motor or a gasoline engine has also been developed by the Oilgear Company. The principle of operation is similar to that of the feed control system, securing for the operator a wide range of speed changes in either direction through the manipulation of a single control handle.

Japanese Shipbuilding.—At the present time there are 14 Japanese shipbuilding establishments capable of constructing ocean-going merchant ships as compared with a total of 53 yards in 1918. Of these 14 plants only nine are actually engaged in new construction. The estimated output of the Japanese yards for 1921 was 40 vessels aggregating 190,000 gross tons. The maximum output occurred in 1919 when 136 vessels, totalling 621,513 gross tons were built.

The Still Engine

By L. B. Chapman*

This is a combination Diesel and steam engine, devised to increase the thermal efficiency over that of the Diesel engine. The heat ordinarily rejected in the jacket water and to the exhaust is used to produce steam and about 8 percent of this heat is converted into useful work, increasing the brake horsepower of the engine about 30 percent.

FROM the diagram of the Still engine shown in Fig. 1 it will be seen that in its present form the engine is double acting with the Diesel cycle working on top of the piston and the steam cycle below the piston. The water jacket is connected in a circuit with the boiler and an exhaust generator as shown in the diagram. The cooling water enters and leaves the jacket at a constant temperature corresponding to the pressure of the steam in the boiler. The heat absorbed by the jacket water surrounding the combustion cylinder is used to convert the water into steam

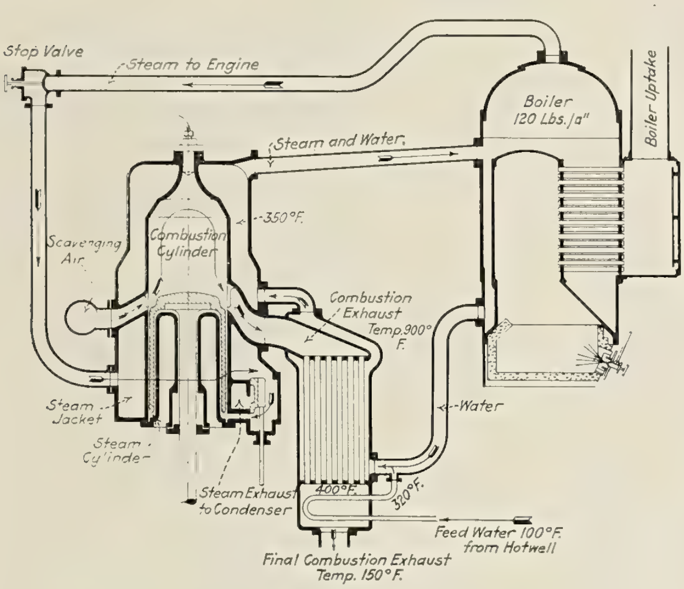


Fig. 1

at constant temperature. In other words, the heat of combustion that radiates through the walls is transferred into latent heat of steam. The steam thus generated passes to the boiler. The function of the boiler is to produce steam for warming up and starting the engine and to augment the supply generated in the jackets, if the jacket supply is not sufficient for the steam end of the cylinder.

The boiler feed water is circulated through the jacket as shown in Fig. 1. The feed water is taken from the feed tank by the feed pump as in all steam plants and is delivered at about 100 degrees to a feed heater or exhaust generator where it absorbs the heat in the exhaust gases. The temperature of the feed water is thus raised from 100 degrees F. to between 350 and 450 degrees F. and the exhaust gases are reduced from 900 to 150 degrees F. The feed water then enters the jacket where it is converted into steam by the heat of combustion.

The steam from the boiler enters the lower part of the cylinder and acts on the piston in practically the same manner as in a steam engine and is then exhausted to the condenser. Cylinder condensation, which is a large loss with the ordinary steam engine, is practically eliminated in the Still engine because of the heat received from the combustion of the gases in the Diesel end.

During compression of the air on the Diesel side of the piston the air charge absorbs heat from the cylinder walls because of the high temperature in the jacket. With the straight Diesel engine the transfer is in the opposite direction, due to the cold circulating water. One result of this is that the required compression pressure is less in the Still engine than in ordinary Diesel engines.

Advantages of Combined Cycles

The advantages due to the interaction of the combustion and steam cycles are summarized by Mr. F. E. D. Acland in a paper before the Royal Society of Arts as follows:

1. The mean temperature of the cylinder walls is higher than in ordinary engines; the cooler parts being maintained at a higher, the hotter parts at a lower, temperature.
2. The piston is cooler, owing to the expansion of the steam behind it.
3. The heat efficiency of the combustion cycle is augmented owing to the walls being at a higher and constant temperature, and is in proportion to the rise in temperature of the jacket water.
4. Frictional losses are reduced by the higher temperature, and by the steam overcoming the inertia of the reciprocating masses at the lower dead center.
5. The mechanical efficiency of the whole engine is higher than that obtainable in a normal engine of similar type.
6. The steam, expanding as it does in a cylinder hotter than itself, gives an indicator diagram larger than that theoretically obtainable under ideal conditions in an ordinary steam engine.
7. Twenty-nine percent of additional brake horsepower is added to the shaft of the engine without increase in the fuel consumption. (Steam not condensed.)
8. Forty percent is added when condenser is used. (Air pump separately driven.)
9. The indicated horsepower due to steam appears as brake horsepower added to the shaft, all the mechanical losses having already been accounted for in measuring the combustion brake horsepower.

Besides the merits listed above the two-cycle Still engine has the following advantages:

1. Fuel consumption 10 to 20 percent lower than the Diesel engine.
2. Absence of cold circulating water causing large temperature difference and trouble with cylinder and head castings.
3. Absence of cylinder condensation in steam end.
4. Lower compression pressure.
5. Absence of air starting, circulating and piston cooling system.
6. Absence of exhaust valves and gear.
7. Increased horsepower for a given bore and stroke.
8. Possibility of overload by forcing steam boiler.
9. Maneuvering at low revolution per minute is possible.
10. High temperature range 2000 to 150 degrees F. (Carnot efficiency).

Trials with a single cylinder two-cycle Still engine were carried out during 1921 by Scott's Shipbuilding & Engineering Company, Greenock, Scotland. Owing to the fact that the experimental engine had only one cylinder, it was necessary to provide a small auxiliary high pressure steam cylinder, the lower end of the main Still cylinder serving as a low pressure steam cylinder. In an actual installation where several cylinders are used the lower part of one can

*Professor of naval architecture and marine engineering, Lehigh University, Bethlehem, Pa.

be used as a high pressure cylinder and the lower part of another as a low pressure cylinder, thus obviating the use of an auxiliary cylinder. All the auxiliaries except the scavenging air pump were driven off the main engine in these trials.

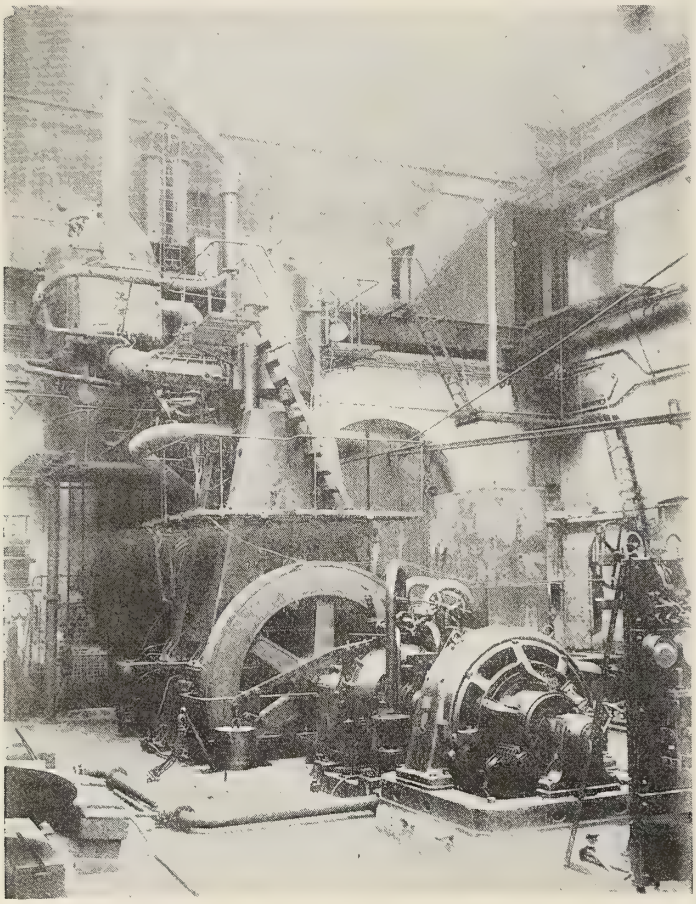


Fig. 2.—Still Engine Undergoing Shop Test

A photograph of this engine is shown in Fig. 2, and a diagrammatic view showing all the auxiliaries in Fig. 3.

The result of the trials of this engine are given in the following table:

Trials of 22-Inch by 36-Inch Still Oil Engine

Main Still cylinder—Stroke, 36 inches. Bore, 22 inches. Piston rod, 6¼ inches.

Auxiliary high pressure cylinder—Stroke, 14 inches. Bore, 22 inches.

	Over-load	Full Load	Half Load
1. Average combustion M. E. P., lbs. per sq. in.	88.9	81.2	54.2
2. Average steam M. E. P. referred to H. P. .	4.43	3.80	1.26
3. Average steam M. E. P. referred to L. P. .	7.36	6.23	3.60
4. Total M. E. P.	100.69	91.25	59.06
5. R. P. M.	128.1	124.3	103
6. Steam boiler pressure, lbs. per sq. in. gage.	112	100	108
7. H. P. receiver pressure, lbs. per sq. in. gage.	75	57	23.5
8. L. P. receiver pressure, lbs. per sq. in. gage	11	5.5	0.4
9. Vacuum, inches Hg	28	27.5	26.6
10. Water evaporated per hour, lbs.	950	807	388
11. Scanvenging pressure, inches water	49	46	40
12. H. P. for scavenging	15.4	14.1	12.0
13. Combustion I. H. P.	394	349.5	192.5
14. Total I. H. P.	446	392	210
15. Engine B. H. P.	384	343	174.5
16. Net B. H. P. (line 15—line 12)	368.6	329	162.5
17. Oil per hour, lbs.	146.6	123.4	64.0
18. Oil per net B. H. P. per hour	.398	.375	.394
19. Efficiency on net B. H. P., percent	35.5	37.7	35.8

It will be observed that the fuel consumption at full load is 0.375 pound per brake horsepower, which is about 10 percent lower than the best four cycle Diesel practice and nearly 20 percent better than the general run of two cycle Diesel engines.

Claims are put forward that the Still engine weighs less and occupies less space than the Diesel engine. The gain in economy of between 10 and 15 percent for this single cylinder engine is highly encouraging and no doubt this can be improved upon when several cylinders are used. At first thought the engine appears complicated but it must be borne in mind that the air starting, circulating and piston cooling systems are eliminated and the small boiler employed with

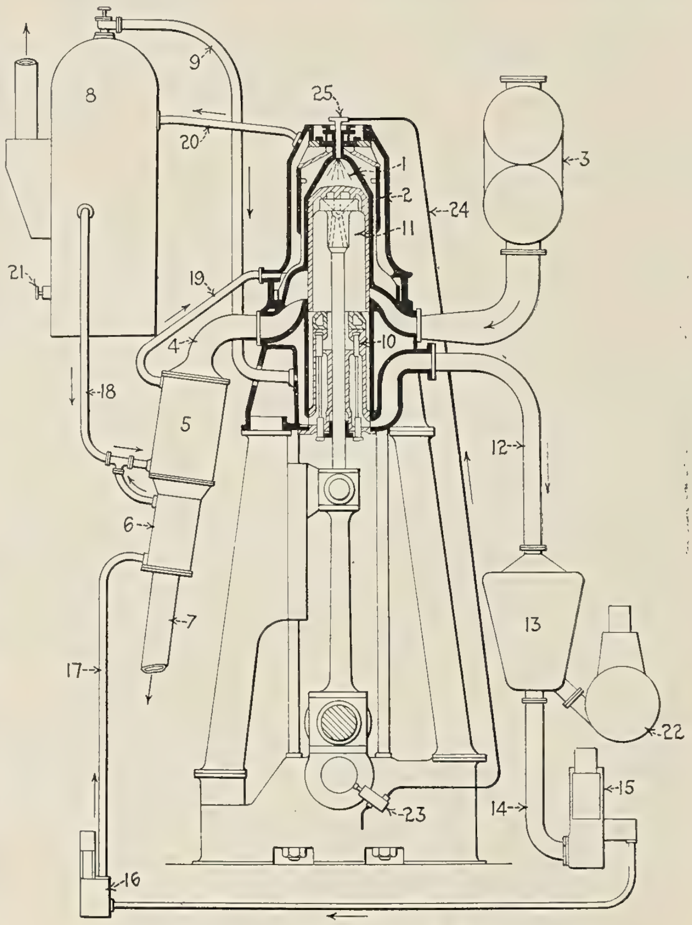


Fig. 3.—Section Through Still Engine

1. Combustion Cylinder.
2. Reinforcing Steel Hoop.
3. Scavenging Blower.
4. Combustion Exhaust Pipe Jacketed by Boiler Water.
5. Exhaust Generator.
6. Feed Water Heater.
7. Final Combustion Exhaust to Atmosphere.
8. Boiler.
9. Main Steam Pipe.
10. Steam Inlet and Exhaust Valves.
11. Steam Cylinder.
12. Steam Exhaust to Condenser.
13. Condenser.
14. Suction Pipe to Air Pump.
15. Air Pump.
16. Feed Pump.
17. Delivery Pipe to Feed Heater.
18. Circulating Water, Boiler to Exhaust Generator.
19. Circulating Water, Exhaust Generator to Cylinder Jacket.
20. Circulating Water and Steam; Jacket to Boiler.
21. Auxiliary Oil Burner.
22. Condenser Circulating Pump.
23. Oil Fuel Injection Pump.
24. Oil Fuel Delivery to Injection Valve.
25. Injection Valve.

the Still engine would generally be required on a Diesel ship for heating purposes.

It would seem that the claims of the inventor are borne out by the recent trials and the engine has excellent possibilities for marine propulsion. The diagrams, photograph and data in the above article were kindly supplied by the Still Engine Company, of London.

Munson Elected Member of Executive Committee of Merchant Marine Association.—Frank C. Munson, president of the Munson Steamship Lines, has been elected a member of the executive committee of the National Merchant Marine Association, according to an announcement by Senator Joseph E. Ransdell of Louisiana, president of the association. "Mr. Munson's election to the executive committee," says Senator Ransdell, "is very important, as he brings to it long practical experience in steamship management, both as owner and as operator of United States Shipping Board vessels."

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Weight of Speaking Tubes on Warships

Q. (1156).—Can you give me an idea of the weight devoted to speaking tubes on a war vessel?

A. (1156).—During recent years the necessity of prompt communication between various parts of a vessel has been emphasized. The effect in terms of weight in the case of war vessels is apparent from the figures given below for brass voice tubing and fittings:

	Tubing	*Fittings*
Battleship	56,000 pounds	19,000 pounds
Scout	10,500 pounds	3,500 pounds
Destroyer	7,250 pounds	1,950 pounds

Point of Maximum Valve Lead

Q. (1147).—If a marine engine has a given lead (on the top and bottom dead center), is that the greatest lead or full port opening that the valve will have? In other words that lead will not increase as the crank leaves the dead center top or bottom?

A. (1147).—In practice the port opening does increase as the crank leaves dead center. In order that full port opening might exist at dead center or the beginning of the stroke the radius of the eccentric would have to be in line with the crank radius; that is, the eccentric would be on the opposite dead center to that of the crank. Such an arrangement would mean that cut-off would begin with the commencement of the stroke and that all the other operations of the cycle, expansion, exhaust, etc., would take place in their order at a correspondingly earlier point in the stroke than in good practice.

Mean Effective Pressure

Q. (1148).—Don't you think 110.875 pounds is pretty high for a mean effective pressure in the following example? What do you think of the formula?

A marine engine has an absolute pressure of 125 pounds per square inch, with a cut-off of ⅝ of the stroke. The pressure in the condenser is 14 pounds or 28 inches of vacuum. What is the mean effective pressure?

Constant for a ⅝ cut-off from slide rule is .919, then $125 \times .919 = 114.875 - 14$ or 100.875 mean effective pressure.

A. (1148).—With a vacuum of 28 inches (corresponding to 14 pounds pressure) in the condenser a pressure of, say 3 pounds (known as back pressure) might be expected at the engine exhaust which we will call p. With ⅝ cut-off the number of expansions would be $1 \div .625 = 1.6 = r$.

P_1 = pressure in steam chest = 125 pounds absolute

$$P_m = \text{theoretical M.E.P.} = P_1 \times \frac{1 + \text{hyp. log } r}{r} - p$$

$$= \left(125 \times \frac{1 + .47}{1.6}\right) - 3 = (125 \times .919) - 3 = 111.9 \text{ pounds}$$

The value of P_m is a figure which might be expected from a perfect engine having dry steam expanding at a constant temperature. In the actual engine as built there will be losses in pressure due to friction of steam during admission and cut-off, also through ports and passages, condensation of steam due to the cooling action of the cylinder walls and passages, opening of valve to exhaust before piston reaches end of stroke, also compression and back pressure due to lead. All these losses may be taken care of by a factor, the value of which depending upon the type of engine and valve gear, number of cylinders, piston speed, whether condensing or non-condensing, jacketed or non-jacketed. When possible this factor value should be derived from a similarly constructed engine.

For the single cylinder engine under discussion this factor, which we will call F, may be taken as .70. Then the actual mean effective pressure would be

$$P_m \times F = 111.9 \times .70 = 80.4 \text{ pounds}$$

Bottom Blow Valves

Q. (1152).—Please give a brief explanation of the bottom blow valve of ocean going steamships, and a description of each kind.

A. (1152).—The object of the bottom blow valve is to blow out of the boiler into the sea, with the boiler's own steam, mud and sediment which may collect at the lowest part of the boiler, or for emptying the boiler for the purpose of cleaning or examination. In the case of express type boilers where two or more lower drums are fitted, each drum would require its own bottom blow valve.

The valve may be attached directly to the boiler or as is often the case an intermediate blow-off cock or valve may be fitted. The one nearest the boiler being opened wide and an outer valve used to control the blowing-off operation. The valve's location should be at the lowest point; but, if this is found to be impracticable, it may be placed at some higher point with a connecting internal pipe running to the bottom point. This valve in turn is piped to a valve at the ship's shell.

There are so many blow-off valves on the market, that it would be impossible to enumerate their detail differences. They may, however, be divided into four principal types and designated as "seat," "seatless," "gate" and "cock."

The first type is much on the order of an ordinary globe or angle valve in appearance, the seat being easily removable and so designed together with its disk as to eliminate so far as possible the lodging of scale in such a way as to prevent the valve being closed. The valve is so attached that steam is always on top of the disk.

The second type consists essentially of a hollow piston, either with a series of ports around its circumference or an internal elbow passage, and is so constructed that there will be no projection upon which scale or sediment can collect. The pressure is against side of piston when valve is closed.

The third type is essentially a specially designed gate valve which permits of a straight through flow when the disk is drawn up to its open position.

The fourth type is simply a plug cock having a spring or other device on the top side of the plug for holding it securely in place and to take up wear, thus preventing the accumulation of scale and sediment.

LETTERS TO THE EDITOR

Oil Burners Overtax Feed Water Heaters

I have read with much interest your article in the February number of Marine Engineering and Shipping Age concerning the trial of the S.S. *Independence,* fitted with Peabody-Fisher wide range, one-man control oil burners. This article was much to the point. I note, however, that it states that the low temperature of the feed water was due to the arrangement of the measuring tanks installed on the boat deck.

This arrangement consisted of pumping the water from the hot well up to the measuring tanks, from which it was discharged into a temporary tank on deck, to which the suction of the feed pump was connected. It will be obvious, therefore, that very little loss in temperature in the feed water took place, as the only source of cooling would be a slight amount of radiation during the passage of the water from the measuring tanks to this temporary "hot well."

On the other hand, please note that we were making steam at a rate very much beyond the ordinary requirements and the excess steam was escaping through the safety valves. In fact, during the latter part of the test, more than 62,000 pounds of steam were being generated per hour, whereas the maximum requirements of the vessel were estimated at 45,000 pounds.

Thus the quantity of feed water passing through the heater was far in excess of the normal amount, while the exhaust steam from the auxiliaries entering the heater remained unchanged; the natural consequence being that there was not enough exhaust steam to heat the abnormal amount of feed water above 168 degrees.

This, of course, is no reflection on the design or operation of the machinery but merely an example of the very high capacity at which the boilers were being forced. If the boilers had not been forced, the feed temperature would possibly have been 210 degrees Fahrenheit or more.

I subscribe fully to your comment concerning the effectiveness of the soot blowers. Had they been used earlier in the test, doubtless a still higher efficiency would have been obtained from the boilers. However, I am sorry that you did not add a statement to the effect that very little or no smoke was produced during the trial, as it might appear to the average reader that the boilers were badly sooted up during the trial. This, of course, was not the case.

At about the end of the trial, while the vessel was entering the harbor at full speed, the engineer got a bell to stop and the main engine was immediately shut down. The operation of our wide range control came into service at this time and merely by the turn of one valve on the bypass line all fires were reduced in capacity so that the safety valves were prevented from blowing. At the end of a period of about five minutes the signal "full speed ahead" was given and again, by the turn of the valve, the fires were accelerated and the steam pressure maintained, with the engines developing full capacity.

In other words, it was not necessary to touch any of the burners; none of them was extinguished; cold air was prevented from entering the furnaces (thus preventing contraction strains) and, when starting up again, it was not necessary to get out the torch and light up any burners.

It has been claimed that our flexible system is of no use on merchant vessels, where the load on the boilers is uniform and steady. However, the above incident shows that there are many occasions when the bypass comes into excellent service. No change of tips is necessary when getting up steam on cold boilers. All maneuvering is easily handled by the bypass, and it frequently happens at sea that on account of fog or heavy weather the engines have to be slowed down.

The tanker *Illinois* of the Texas Company has now been in service some eight months, and it has been found that the flexibility of the system is of great advantage.

New York.

Peabody Engineering Corporation,
E. H. Peabody, President.

Marine Boilers

In your issue of September, 1921, there appears an article entitled "The Selection of Propelling Machinery," by Professor Lawrence B. Chapman, in which he, like many other persons, makes comments upon marine boilers which, I believe, are not justified.

He begins the part on boilers by stating that the lighter express types of watertube boiler are unsuitable for merchant service, and ignores the fact that the *Berengaria* (ex-*Imperator*), *Leviathan, Great Northern, Northern Pacific* and most of the "State" ships of the Shipping Board have such boilers and apparently are satisfactory. The forthcoming *Majestic* of the White Star Line also has them and I imagine that many ships in the future will be so provided. The *Berengaria, Leviathan, Majestic* and "State" ships have boilers of the Yarrow type and the *Great Northern* and *Northern Pacific* have Mosher boilers. I have not heard of any trouble from them and it is well known that the two latter steamers, when used for transports, made the quickest round trips between New York and Brest of any steamers.

Concerning Professor Chapman's comments on Scotch boilers, I disagree with him and assert that the Scotch boiler has good circulation after it has once been heated up; that it can be easily forced and that its efficiency is superior to that of any marine watertube boiler. With it it is important to raise steam slowly and to circulate the water artificially while this is being done. When the results of the tests of the 15-foot 3-inch Scotch boiler at the Sun Shipbuilding Company's plant at Chester, Pa., carried out by the Emergency Fleet Corporation in 1920-21 are published, many persons will be enlightened on these matters. They will find that the combustion was excellent, that the economy was unusually high, that the circulation was perfect, as shown by thermometers inserted through the shell at top and bottom, and that there were no drawbacks.

Concerning forcing, what can possibly prevent burning a large quantity of coal in a Scotch boiler, if the draft is sufficient—that is what forcing consists of. The draft, being usually artificial, can be sufficient to force any boiler. Can the Sotch boiler respond with economy when forced? It surely can, and the Emergency Fleet tests prove it, especially when retarders are used. People are misled by the temperatures of the escaping gases from Scotch boilers. They are higher than from watertube boilers because there is no air leakage to cool them as in the case of watertube boilers. This is a valuable feature as the hotter gases are effective in superheating the steam and heating the air with the Howden system.

Is there any reason for anticipating more injury to a Scotch boiler from forcing than from ordinary use? I can see none as the distribution of temperatures is as equable when forcing as when not, and it is the absence of this that causes injury to boilers. Furthermore, unusual forcing of boilers at sea seldom occurs.

By an examination of an article in *The Engineer* of September 23, 1921, on the tests of the Inglis Scotch boiler it will be seen that this boiler surpasses in economy all other boilers in existence, whether on land or sea, even when burning 49 pounds of coal per square foot of grate per hour

with an air pressure of 3 inches, and apparently without heated air for combustion. The tests of these boilers were made by five different firms or individuals in good standing, and the results were as follows:

Tests by	Coal burnt per square foot grate per hour, pounds	Heat value of coal, B. T. U.	Temperature of escaping gases, degrees F.	Evaporation per pound of coal from and at 212 degrees F., pounds	Efficiency, percent
Burstall & Monkhouse	19.82	14,350	439	12.97	87.34
	27.31	14,280	482	12.24	82.80
	48.89	13,890	523	11.33	78.80
Prof. Stanfield	20.10	14,080	457	12.70	87.58
	33.20	14,080	475	11.82	81.32
	48.00	13,600	524	10.94	77.82
John Brown & Company, Ltd.	38.70	13,647	498	12.08	85.00
	48.90	13,647	593	11.40	80.20
Denny & Company	16.20	13,864	470	12.87	89.50
	19.00	13,864	410	12.70	88.40
	29.00	13,864	440	12.08	84.10
The Fairfield Shipbuilding & Engineering Company, Ltd.	19.20	13,952	445	12.45	86.21

These results easily surpass any that have ever been obtained from any other type of boiler, when hand fired, and constitute an epoch in boiler performance. The Inglis Boiler Syndicate guarantees 80 percent efficiency, which has never been done before.

The Scotch boiler lends itself to superheating readily, and, by the use of the locomotive type of superheater, to high degrees. Its defects are its cost, weight and space occupied. It is not as sensitive to salt as the watertube boiler, salt being the great enemy of the latter.

Boston, Mass. F. W. Dean

NEW BOOKS

Electric Ship Propulsion. By Commander S. M. Robinson, U. S. N. Size, 6 by 9 inches. Pages, 274. Illustrations, 140. New York, 1922: Simmons-Boardman Publishing Company.

Electricity as a prime mover for ships has been proposed for many years and a number of excellent papers on this subject have been presented from time to time before technical societies both here and abroad. It has remained, however, for Commander Robinson to present the first book devoted in its entirety to electric propulsion.

The United States Navy was the first to recognize the possibility of electric drive for ships and the author's experience with the design and operation of naval craft so propelled is such as to place him among the foremost authorities on this subject in the world. As might be expected, a goodly portion of the book is devoted to electric drive installations in naval vessels, but the application of this method of propulsion to merchant craft is taken up in no less detail.

Chapter I deals with the history of electric propulsion and the types of ships for which it is best adapted. Comparison of electric with turbine and Diesel installations is made clearly and concisely and deductions arrived at which indicate the type of machinery best adapted for various classes and types of vessels.

Chapter II describes the electrical systems most suitable for marine propulsion and discusses the reasons for different systems in various types of craft.

In Chapter III the characteristics of propellers are dealt with from the viewpoint of the effect of the propeller on the design of the ship's motor. The design of motors and generators to meet the conditions imposed by the propellers is fully treated in Chapter IV, while Chapter V describes the characteristics of turbines and governors for electric propulsion.

Ventilation and heaters as a means of protecting the motors and generators are described in Chapter VI as are also proper fire extinguishing apparatus for preventing damage from fire caused by a short circuit. Switchboards, interlocks and control apparatus are dealt with in Chapter VII, and the proper type and kind of wire, cable, insulators and insulation is given in Chapter VIII.

Chapter IX takes up the installation of exciters and other auxiliaries which are required for furnishing excitation to the main generator field. The next five chapters are devoted to describing in detail the electric drive installations installed in some of the naval vessels including the initial experimental installation in the collier *Jupiter* and the latest improvements as installed in the latest battleships.

A typical installation in a ten-knot cargo vessel of 6,000 tons capacity is described in Chapter XV where the Ljungstrom system of electric propulsion, as applied to the *Wulsty Castle*, is set forth in detail. Chapter XVI is devoted to the description of Diesel electric drive and deals with the future possibilities of this type of prime mover for merchant vessels, while the concluding chapter describes the care and upkeep of electric propulsive units and gives a number of practical hints which will aid in keeping the machinery in proper working order.

Commander Robinson's book has been skilfully prepared and its value is greatly increased by the many illustrations showing actual details of existing installations. The increasing trend of modern practice in the direction of the application of electricity as a prime mover for ships has created a demand for an authoritative text-book on this subject which is fully met by this book. It should have a place in the libraries of all students of modern marine engineering.

PERSONAL MENTION

George H. Wells, of the traffic department of the Shipping Board, is to be appointed to the executive staff of the United States Lines.

Francis M. Wolf, who has been assistant passenger traffic manager of the Munson Steamship Line, has been made passenger traffic manager.

J. T. Borden, formerly of Chester, Pa., has been placed in charge of the recently opened New York office of the Sun Shipbuilding Company at 25 Broadway.

Gale H. Carter, a director of the Pacific Mail Steamship Company since last September, has been elected president of the company to succeed George J. Baldwin.

George J. Baldwin, president of the Pacific Mail Steamship Company, has been elected to the newly created office of chairman of the board. Mr. Baldwin's resignation as president will relieve him of the active management of the company, which he has had for the past six years.

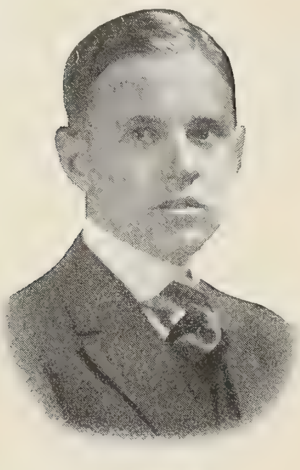
R. H. M. Robinson, chairman of the executive committee and, during the past year, acting president of the United American Lines, has been elected president of the company. At the same time A. D. Tomlinson was elected vice-president. Mr. Tomlinson is vice-president of the American-Hawaiian Steamship Company, for which the United American Lines are managing agents.

George G. McIntosh, formerly passenger traffic manager of the Munson Steamship Line, will assume the duties of European service manager for this company.

R. I. Dunigan has been named as successor to Edward Wortmann as assistant general passenger agent of the United States Lines. Mr. Dunigan was formerly traffic director for the Baltic Steamship Company.

M. J. Buckley, assistant to A. J. Frey, vice-president of the Shipping Board, has resigned and intends to return to San Francisco, where he was formerly connected with the Pacific Mail Steamship Company.

Charles F. Gross of Baltimore, Md., has been made assistant professor of marine engineering and naval architecture at the College of Mechanics of the University of California, Berkeley, Cal. Professor Gross graduated from the department of naval architecture and marine engineering of the Massachusetts Institute of Technology, after which he became instructor at the United States Naval Academy, Annapolis, Md., in the department of marine engineering and naval construction. For some time after the war he was associated with the Union Shipbuilding Company, Baltimore, Md. Professor Gross is a member of the Society of Naval Architects and Marine Engineers and of the American Society of Naval Engineers. The course in naval architecture with which he is connected at the University of California was started in January, 1918, under the instruction of Professor D. W. Dickie, a well known naval architect on the Pacific coast.


Charles F. Gross

Eric Krag has been appointed manager of the newly formed chartering department of the General Steamship Corporation, San Francisco, Cal. He was formerly connected with the East Asiatic Company in Copenhagen and came to this country in 1914 as assistant general Pacific Coast manager of the company.

J. P. Sutherland has been appointed eastern passenger agent for the Pacific Mail Steamship Company with headquarters at 10 Hanover Square, New York City, to handle the newly established San Francisco-New York service of the company. Mr. Sutherland was formerly manager of the passenger and mail section of the United States Shipping Board.

J. L. Ackerson, president of the Atlantic Coast Shipbuilders' Association, has been named a member of the committee recently formed by the Chamber of Commerce of the United States to consider policies to be adopted in connection with the American merchant marine. The committee is made up of men prominently identified with business and shipping interests.

James W. Boring has been appointed manager of the advertising department of the United States Shipping Board Emergency Fleet Corporation to succeed M. B. Claussen who was forced to resign this position on account of ill health. Mr. Claussen, however, will remain in the employ of the Shipping Board, supervising the development work of the various transpacific passenger services on the Pacific coast and in the Orient.

P. J. Pearce was recently elected president of the Puget Sound Maritime Circle. Mr. Pearce has been acting president of the organization for some time. The Maritime Circle comprises staff employees of steamship and transportation companies in Seattle.

Joseph Scott, assistant general manager of the States Marine and Commercial Company, New York, has resigned this position to become manager of the steamship department of the Transmarine Corporation, a subsidiary operating company of the Submarine Boat Corporation.

E. E. MacNary has been named by General Manager Rossbottom of the United States Lines to succeed J. M. Kennedy as general passenger agent of the company. Mr. Kennedy was recently transferred to London to act as European passenger agent for the lines with headquarters in London.

George W. Sterling, former assistant director of operations of the United States Shipping Board at New York, was recently elected president of the Foreign Transport and Mercantile Corporation. Mr. Sterling while with the Shipping Board acted as receiver for a number of companies which had bought Shipping Board tonnage and defaulted on their commitments for the vessels.

Captain Eugene O'Donnell, manager of the marine department of C. H. Sprague and Sons, Boston, Mass., has resigned as chairman of the committee on sea-going personnel of the American Steamship Owners' Association. President Raymond of the association has appointed A. J. McCarthy, vice chairman of the committee and manager of the American flag steamers of the International Mercantile Marine Company, to this post.

Robert Taylor Merrill has become director of the Bureau of Research of the United States Shipping Board. Mr. Merrill, prior to coming with the Shipping Board, was connected with the Oriental Navigation Company, in the capacity of operating vice-president. He is a graduate of the United States Naval Academy and during the war was supervisor of the United States naval auxiliary reserve, charged with the supervision of the officers and men of the merchant marine enrolled in the Navy. He was also district supervisor of the Naval Overseas Transportation Service, in charge of the physical handling of supply ships running to Europe. On his resignation from the Navy in 1919 he held the rank of lieutenant commander. The Bureau of Research will conduct investigations into maritime matters, making studies of world shipping and shipbuilding conditions in relation to their effect on American shipping.


© *Kadel & Herbert*
Robert T. Merrill

Nathan A. Smyth has been named as general counsel of the Emergency Fleet Corporation. The object of Mr. Smyth's promotion to the position of general counsel is to bring about a segregation of the legal work of the Shipping Board from that of the Fleet Corporation. Before becoming assistant to Elmer Schlesinger, general counsel of the Shipping Board, last July, he was associated with the law firm of Rushmore, Bishbee & Stern of New York. He was born in Quincy, Ill., in 1876, graduated from Yale in 1897 and the Yale Law School in 1900.

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

Principal Details of Three Turbo Electric Ferryboats For New York City, To Cost Approximately $1,330,000

Vessels Will Be 218 Feet in Length Each, for Service to Staten Island—City Establishes New Record

PLANS and specifications for the construction of three electric drive steel screw ferry boats for the City of New York, having an estimated cost of $1,330,000, have been submitted by Grover A. Whalen, Commissioner of Plant and Structures, to the Board of Estimate and Apportionment for approval, according to official information obtained by MARINE ENGINEERING AND SHIPPING AGE. The boats will have a length over all of 218 feet, length between end posts, 215 feet; beam over guards, 64 feet; beam molded, 45 feet; depth of hull at side molded, 18 feet.

Alternative bids are to be submitted for certain parts of the work and a lump sum bid per boat must be submitted for building two boats and three boats complete. The first boat must be entirely completed within 245 consecutive calendar days from date of certification of the work; the second boat within 275 consecutive calendar days from date of certification and the third boat within 305 consecutive calendar days from date of certification. The amount of security to guarantee the faithful performance of the contract will be $400,000.

The vessels are to be double ended ferry boats for carrying passengers and vehicles between St. George, S. I., and Manhattan, and are to have four driveways on the main deck without cabins, and a cabin and outside seats on the upper deck. The hulls and main decks are to be built of steel with steel main house sides and steel center house; upper decks together with houses and decks above to be built of wood. The Isherwood system of longitudinal framing will be used in the hull construction.

Alternative propositions will be received for steering gears, one providing for the installation of a steering gear on each end of the boat of the electric drum type together with a hand steering gear, each set being complete and independent of the other, and the second providing that a steering gear be installed on each end of the boat of the parallel cylinder electro-hydraulic type.

MACHINERY

For each vessel there will be one main turbine of the impulse type, direct connected to the main generator. This turbine shall be capable of delivering a maximum of 2,200 horsepower at the propeller shafts. The turbine speed shall be not less than 3,000 revolutions per minute when delivering 2,200 shaft horsepower. Under normal operating conditions the total shaft horsepower will be 1,900.

There will be one main generator designed for 2,300-3,000 volts and a maximum operating speed of not less than 3,000 revolutions per minute. Excitation required at full load when delivering 2,200 horsepower at the propeller shafts is not to exceed 20 kilowatts.

Two main propulsion motors are to be provided and installed of the three-phase, alternating current, induction type, 2,300-3,000 volts. Each motor is to be provided with a stator winding for operating the stern propeller at full speed and power (2,100 horsepower and about 176 revolutions per minute) and a stator winding for operating the bow propeller at reduced speed and low power (about 100 horsepower and 132 revolutions per minute).

AUXILIARIES

There will be two direct current turbo-generator auxiliary sets of 125 kilowatt capacity each.

All auxiliary motors are to be of the marine, direct current, compound or shunt wound, commutating pole, continuous rated, self-ventilated, splash-proof type, operating at 220 volts.

There will be one surface condenser installed in the engine room of the horizontal centrifugal, two-pass type, containing not less than 4,000 square feet of cooling surface.

The circulating pump is to be of the centrifugal, double suction, high speed type with a capacity of not less than 5,000 gallons per minute against a total head of 20 feet.

The condensate pump is to be of the centrifugal, balanced side suction, high speed type, direct connected to a motor. Two duplicate air ejectors are to be installed on the condenser, each one having a capacity sufficient to meet maximum conditions.

The steam pump equipment will include two vertical simplex feed pumps, one horizontal duplex fire and general service pump, two vertical simplex bilge pumps. One centrifugal double suction high speed salt water service pump, motor driven and one rotary type fresh water pump, motor driven, are also to be provided.

BOILERS

Four watertube boilers are to be installed The boilers are to have a working pressure of 250 pounds per square inch and to be constructed to allow for the installation of superheaters.

A superheater is to be installed in each boiler having sufficient surface to maintain 200 degrees of superheat to 30,000 pounds of steam per hour with four boilers in use under natural draft or with three boilers in use under forced draft.

Million Dollar Conversion Job, Involving Eleven Ships, Is Planned

Approximately a million dollars' worth of ship conversion work is receiving the serious consideration of the Admiral Line, of which H. F. Alexander is president, according to information obtained by MARINE ENGINEERING AND SHIPPING AGE. Mr. Alexander, who is at present in the East, is making his headquarters at the office of the Dollar Line, 11 Moore street, New York City. It is understood that the project now under contemplation involves the conversion of 11 vessels, 7 of which are steamers and 4 steel barges, into Diesel driven ships for freight service.

Five of the steamships, which are similar to the steamer *Cottonplant* type built by the Great Lakes Engineering Works for the Shipping Board during the war, are at present tied up at Norfolk, Va., and the other two steamships, the *Wallingford*, built by the Long Beach Shipbuilding Company, and the *Silverado*, built by the Craig Shipbuilding Company, are laid up on the Pacific Coast. The steamers are all about 4,000 deadweight tons each.

The barges, it is reported, are the *Dawnlite, Daylite, Starlite* and *Moonlite*, of about 3,000 deadweight tons each, and are tied up at Baltimore, Md.

It is believed that the conversion of the steamships, which are now equipped with triple expansion reciprocating engines, into motorships will cost $100,000 each with a probable cost of about $75,000 each for the installation of similar motive power in the barges.

Sun Shipbuilding Company to Build Doxford Opposed Piston Two-Cycle Oil Engines

Arrangements have been completed with the Sun Shipbuilding Company of Chester, Pa., for uniting the interests of the American Junkers Patents with Doxford Patents which have been the basis of the developments forming the Doxford opposed piston two-cycle oil engine.

The Sun Shipbuilding Company have already secured the full license in America and its possessions of the Junkers Patents and it will operate both interests in America. An immediate start is to be made at the Chester Works on the construction of a four-cylinder 3,000 horsepower single screw installation, being a duplicate of the Doxford manufacture, two of which engines are already at sea in the motor ships *Yngaren* and *Dominion Miller*.

This type of engine opens up with the brightest expectations to question of installing single screw Diesel engines for all types of vessels up to a very large tonnage.

Sun Shipbuilding Company Announced As Successful Bidder For New West Coast Express Passenger Ship Costing $1,027,000

ANNOUNCEMENT is made of the awarding of the contract for the construction of an express passenger steamer for the Inter-Island Steam Navigation Company of Honolulu, T. H., to the Sun Shipbuilding Company, Chester, Pa., at a price of $1,027,000 and 285 days, this company submitting the lowest bid. The vessel will be 360 feet in length and will have a speed of 16½ knots. She will be used in service around the Hawaiian Islands.

Thirteen bids were submitted by various Atlantic and Pacific Coast yards as follows:

		Days
Sun Shipbuilding Co.	$1,027,000	285
Newport News Shipbuilding & Dry Dock Co.	1,100,000	285
Bethlehem Shipbuilding Corporation	1,115,000	305
Federal Shipbuilding Co.	1,128,370	300
Los Angeles Shipbuilding & Dry Dock Co.	1,150,000	300
Merchants Shipbuilding Corporation	1,151,489	364
Bethlehem Shipbuilding Corp., San Francisco, Cal., plant	1,199,350	305
New York Shipbuilding Corporation	1,273,500	425
Staten Island Shipbuilding Company	1,275,000	365
Wm. Cramp & Sons Ship & Engine Building Co.	1,340,000	365
Todd Dry Dock & Construction Co.	1,350,000	245
Bath Iron Works	1,360,000	456
Union Construction Co.	1,468,300	300

Steel Hull for Dredge

The United States Engineer Office, Nashville, Tenn., will receive sealed proposals until 11 A.M., April 11, 1922, for the construction and delivery of a steel hull for a dredge. Further information on application.

Bids Asked for Steel Pontoons And Equipment for Dredge At Philadelphia

The United States Engineer Office, Philadelphia, Pa., will receive sealed proposals until 12 o'clock noon, April 6, for furnishing all labor and materials for and constructing 20 steel pontoons, 60 cast steel pontoon saddles and 30 cast steel pipe saddles with "U" bolts and washers, and 168 lengths of 18 feet each of shore discharge pipe complete. This equipment is for the United States dredge *Cataract*. It is estimated that the work will involve the expenditure of close to $20,000. Plans and specifications may be obtained upon application to the Engineer Office.

Contract for Steel, Diesel Driven Houseboat Awarded Consolidated Shipbuilding Corp.

A contract has been placed with the Consolidated Shipbuilding Corporation, Morris Heights, N. Y., for the construction of a new type of houseboat for John Ringling, plans and specifications for which were prepared by Henry J. Gielow, naval architect. The vessel will be of light draft, and combine the seagoing qualities of a good motor or steam yacht with the more material comforts of a houseboat.

The new craft will have an over all length of 125 feet 7 inches; length on load water line 117 feet 9 inches; beam 21 feet 3 inches; and 4 feet 3 inches draft when fully loaded. The propelling machinery will consist of two 6-cylinder Diesel engines of 180 horsepower each.

The boat will be constructed of steel, the shell plating being carried up to the upper deck.

Two Million-Dollar Passenger Ships To Be Built For Eastern Steamship Company For Boston-New York Line

Vessels Will Be of Highest Class, Equipped With Geared Turbine Engines, Burning Oil Fuel and Will Have Accommodations for Over 700 Passengers

BIDS are expected to be received within the next two months for the construction of two new passenger ships for the Eastern Steamship Company, Boston, Mass., at a cost of approximately $1,000,000 each, according to information obtained by Marine Engineering and Shipping Age. It is understood that the vessels are to be ready for operation by June, 1923. Plans and specifications are being prepared by Theodore E. Ferris, naval architect and marine engineer of 30 Church Street, New York.

Approximate figures give the size of the ships as about 400 feet in length over all, 56 feet beam and 17 feet load draft. The vessels will run on the Metropolitan Line between New York and Boston and will probably be more on the ocean type than the Sound type steamers. They will be single-screw ships driven by double reduction geared turbines.

It is understood that each vessel will be equipped with five single-ended Scotch boilers having 16,500 square feet of heating surface, 150 degrees of superheat, steam at 200 pounds pressure, delivering about 5,500 shaft horsepower and 98 revolutions per minute. The boilers will be fired by oil burners.

It is planned to have these ships surpass any other vessels in similar service. They are to be of the coastwise hurricane deck type equipped with complete double bottoms, lower, main, hurricane, promenade and boat decks with ports large enough for the handling of automobiles. They will be equipped to carry about 640 first class passengers in regular room, parlor and suite, and 100 berth travel or steerage passengers.

Norfolk, Va., Takes First Definite Steps Towards $5,000,000 Port Development

The Atlantic, Gulf & Pacific Company, with offices at Norfolk, Va., is low bidder, at a price of 17.89 cents per cubic yard, for the dredging of 750,000 cubic yards in the channel approaching the new Norfolk municipal terminals, which will be the first step in the construction of these facilities provided for in the recent $5,000,000 bond issue election. The bids have been referred to City Manager Ashburner for analysis and recommendations.

The company agreed to start the work in ten days after contract is awarded, and guaranteed to dredge 125,000 cubic yards per month until the work is finished. On two separate items of work in connection with this project and which embody certain small dredging and filling operations this company bid 30 cents and 50 cents per cubic yard, respectively. Their whole bid will bring the entire operation to $140,000.

Work on the terminals will begin with the least possible delay, the Port Commission has announced, and it is expected that before spring is far advanced the terminals will be under construction.

One of the big factors which entered into the bid of the Atlantic, Gulf & Pacific Company for the first dredging work, necessary to be done before the construction of the terminals can begin was the fact that this work could begin on ten days' notice. The element of time is the essence of the situation with regard to the grain elevator, in the opinion of the commission, because it must be ready for the next fall crop of grain or lose an entire year of operation.

As soon as the elevator plans are under way, plans for the piers and warehouses will be taken up. The commission feels that while all the development is urgent, its energies must be concentrated on construction of the elevator, to be followed by active steps to complete the entire project.

47,000 Gross Tons of New Shipping Admitted to American Registry During Month of February

The Bureau of Navigation, Department of Commerce, Washington, D. C., reports 39 sailing, steam, gas and unrigged vessels of 38,359 gross tons built in the United States and officially numbered during the month of February, 1922.

No vessels are reported as having been built in this country for foreign owners during the month.

Forty-three vessels having a total of 24,909 gross tons were reported as transferred to foreign flags during February.

From other sources than construction two vessels having a total of 8,646 gross tons were admitted to American registry.

Ship Bids Rejected

All bids received for the 1,490 Shipping Board vessels recently announced for sale have been rejected by the Shipping Board. About 100 bids were received in all and, according to a statement by Chairman Lasker, "there was not a serious bid in the whole lot." He spoke of them as facetious and declared that he was convinced there was no market for ships now and there probably would not be until the subsidy question now before Congress was decided.

Philadelphia Preparing to Spend Millions For Expansion of Its Pier Facilities; Bids Now Being Asked

The Department of Wharves, Docks and Ferries, Philadelphia, Pa., is soliciting bids which will be received and opened at 12 o'clock noon, March 24, 1922, for the construction of the superstructure of Pier No. 84, South Wharves, the substructure of which has already been completed at a cost of $1,292,202.76. The substructure is 300 feet wide and 900 feet long, and is of "solid fill" type; upon which will be placed three depressed railroad tracks in the center of the pier. The superstructure will be a two-story steel, and reinforced concrete structure and will cost approximately one and a half million dollars ($1,500,000).

Plans and specifications are now prepared and bids will be solicited some time early in the month of April for the construction of the superstructure of Pier No. 3, North Wharves, and the sub and superstructure of Pier No. 5, North Wharves. These piers are designed as combination piers for either the accommodation of Trans-Atlantic or coastwise and river traffic, each 185 feet wide by approximately 550 feet long, with all docks or waterways 215 feet wide, except that between the first pier, No. 3, and the ferry house, which will be 115 feet. The substructure will be of permanent and massive design and of the type known locally as the "fill-on-platform," which may be described briefly as timber piling supporting a timber deck covering the entire area of the pier near the low water level, and which in turn supports a dry fill deposited on the decking and brought up to the level of the main pier deck, and retained by concrete walls built on the low level decking along the sides and ends of the pier.

The superstructures will be two-story steel and concrete sheds of modern construction throughout, enclosed on the dock sides with an approved type of turn-over cargo doors and terra cotta tile walls, and will be thoroughly equipped with cargo masts, electrically operated elevators and winches, chutes, spiral conveyors and other improved cargo-handling apparatus. Double car tracks leading from the Philadelphia Belt Line Railroad in Delaware Avenue will extend into the sheds for nearly the entire length of the piers, and be depressed so that the car floor will be approximately at the same level as the pier main deck. The first deck will be designed for a loading of 600 pounds per square foot and the second deck for 300 pounds per square foot.

The facades of the pier and bulkhead sheds on Delaware Avenue and the river-end elevations will be architecturally treated in brick and lime stone, and when completed the Delaware Avenue front of the terminal, in conjunction with Cherry Street Pier (No. 9), to which it connects, will present an unbroken elevation, more than 1,000 feet long. The project will cost approximately three and a half million dollars ($3,500,000).

Contemplated Improvements

In addition to the above piers, the Department, will, before the end of the present year, enter into a contract for the construction of the superstructure of Pier No. 82, South Wharves, the substructure of which is now completed and cost $1,329,946.24. This substructure is 300 feet wide by 900 feet long, and is of the "solid fill type," and has been planned for two-story steel and concrete superstructure, with architectural concrete inshore and outshore elevations, with depressed railroad tracks in the center and along the outside of the sheds. The paving of River Street in front of said piers and the construction of a freight handling yard in the rear, the estimated cost of which is three million dollars ($3,000,000).

Private Work

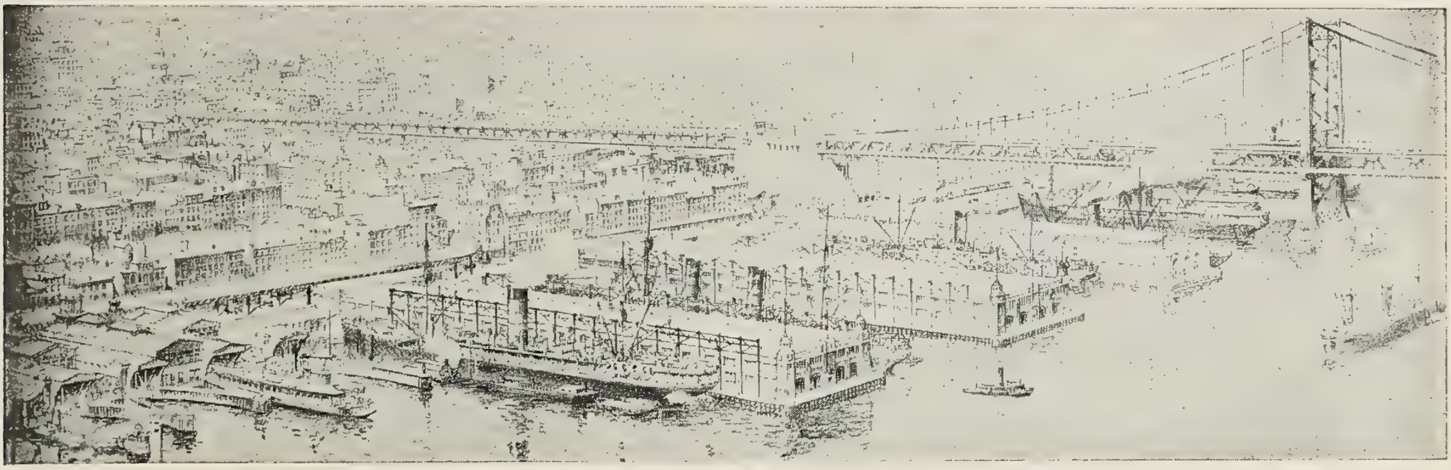
Licenses have been issued to private owners to construct work as follows:

S. B. Vrooman Company, Ltd., to erect a log pond and saw mill in front of their property situated on the Delaware River at Reynolds and Jenks Streets. Estimated cost, $150,000.

Philadelphia and Reading Railway Company, to install a new float bridge, and construct a mud fence in front of property on the Delaware River at Pier "J" Port Richmond. Estimated cost, $64,000.

And applications are now pending for: Philadelphia Electric Company, for the construction of bulkhead in front of their property situated on the Delaware River between Penn Treaty Park and Palmer Street.

Philadelphia and Camden Ferry Company, to construct one additional ferry rack at the foot of Market Street.



Proposed Girard Piers Nos. 3 and 5 North Delaware Wharves.

Seven New Boats Considered for Service in the East River

The City of New York will spend close to a million and a half dollars for new ferries for service in the East River, if present intentions are carried out. It is learned officially that engineers of the Department of Plant and Structures are preparing plans and specifications for at least two and probably seven vessels to ply in the East River. The boats will probably cost about $200,000 apiece.

It is understood that the type of ferry receiving consideration is to be of steel construction, 170 feet in length, the propelling machinery to be of the Diesel electric type. It will probably be several weeks before plans and specifications are available.

Water-Tube Boilers to Replace Scotch on Transport "Madawaska"

The new boiler installation of the United States Army Transport *Madawaska*, now being reconditioned at the yards of the Morse Dry Dock & Repair Company, Brooklyn, New York, will consist of six Babcock & Wilcox Water-tube, two-inch type, built for a working pressure of 250 pounds and having a total heating surface of 24,084 square feet. They will burn coal under forced draft. These boilers are so designed that they will occupy the boiler room space now taken up by the three double ended Scotch boilers in the vessel, the space taken up by a single ended boiler being added to the forward bunkers.

Diesel-Engined Yacht Contract Awarded Tebo Plant

A contract for the construction of a steel Diesel-engined yacht was recently awarded to the Tebo Yacht plant of the Todd Shipyards Corporation. This yacht is being built to the designs of Cox and Stevens for Merrill B. Mills of Detroit.

Her measurements are: 129 feet over all length, 23 feet beam, 6 feet 6 inches draft. The main propelling machinery will consist of two Diesel-type, six-cylinder, four-cycle Winton engines, each developing 225 brake horsepower.

The work of converting the auxiliary yacht *Alcyone* to Diesel electric propulsion is being completed at the same yard.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Reconditioning Steamer, Hoboken, N. J.—Mongolia, of International Mercantile Marine Company, sister ship of Manchuria, is undergoing extensive reconditioning of her first class quarters at Tietjen & Lang plant. Work requires 60 days.

Pontoons, Tug, Coos Bay, Ore.—Port of Coos Bay has ordered four new pontoons for its suction dredge, and has started investigation to determine advisability of owning its own port tug.

Ore Carriers, Alameda, Cal.—Report from San Francisco stated that J. J. Tynan, vice-president and general manager of Bethlehem Shipbuilding Corporation, conferred with Charles M. Schwab regarding construction of new type of Diesel engine and building two 20,000-ton ore carriers.

Scows, Portland, Ore.—Port of Portland Commission let contract for construction of two donkey scows to Portland Shipbuilding Company at price of $1,650 each.

Reconditioning Job, Chester, Pa.—Steamship Columbia, formerly Great Northern, purchased from U. S. Government by Admiral Line, $1,250,000, and contract for reconditioning, same let to Sun Shipbuilding Company. Work will cost approximately $500,000, and includes extensive hull and machinery repairs and installation of accommodations for 675 first class passengers. Ship to be completed latter part of May.

Lake Freighters, New York.—Construction of fifteen lake freighters to cost close to $5,000,000 is contemplated by Central Steamship & Commerce Corporation, 30 Broad street. Plans and specifications for these boats, to be Diesel Electric, for service through Welland and New York Barge Canals, between New York and Chicago, and also to West Indies, when canal traffic is closed, are being prepared by Theodore D. Wells, naval architect and marine engineer, 11 Broadway. Preliminary plans call for special type ship, 257 feet long and equipped with Diesel engines developing 1,300 horsepower.

New Passenger Ship, Chester, Pa.—Sun Shipbuilding Company has been awarded contract for construction of 360-foot passenger steamer of 16½ knots speed, for Inter-Island Steam Navigation Company.

Conversion Work, New York.—Approximately a million dollars' worth of ship conversion work involving installation of Diesel engines in 11 vessels, of which 7 are steamers and 4 barges, is receiving serious consideration of Admiral Line. Conversion of steamers into motorships estimated at $100,000 each, and similar motive power in barges, $75,000 each.

Ferryboats, New York.—Engineers of Department of Plant and Structures are preparing plans and specifications for two and possibly seven vessels to ply in East River. Type of ferry said to be receiving consideration to be of steel construction, 170 feet in length and Diesel electric drive. Boats to cost about $200,000 apiece.

Lightship Overhauling, Jacksonville, Fla.—Lightship Relief LV-53 in dry dock at plant of Gibbs Gas Engine Company for repairs and general overhauling.

Repair Contracts, Baltimore, Md.—United States Shipping Board awarded contract for repairs to steamer Elmsport to Globe Shipbuilding Company at $11,183; steamer Hoxi at price of $6,887, and Meximus at $6,561 to Bethlehem Shipbuilding Corporation and steamer Bella at price of $2,625 to Obrecht & Company.

Vessel Overhauling, Winslow, Wash.—Winslow Marine Railway & Shipbuilding Company's plant at Eagle Harbor is repairing and overhauling local and coastwise vessels to be ready for spring season. Several vessels are awaiting their turn on the ways.

Steam Conversion, Vancouver, B. C.—Bids have been asked by Robert Dollar Company for conversion of steamer Cathay from coal into oil burner.

Ferryboats, New York.—Plans and specifications for construction of three electric drive steel screw ferryboats for operation between St. George, S. I., and Manhattan, have been submitted to Board of Estimate and Apportionment by Grover A. Whalen, Commissioner of Plant and Structures. They will be double-ended and 218 feet in length over all.

Diesel Engine Installation, San Francisco, Cal.—D. W. Dickie has plans for installation of 75-horsepower Enterprise Diesel engine on schooner Sequoia, owned by F. A. Watson, of Los Angeles.

To Enlarge Accommodations, San Francisco, Cal.—Shipping Board steamers Creole State and Wolverine State will have passenger accommodations enlarged to a capacity of 300 steerage, besides present complement of first cabin passengers. When completed vessels will ply in San Francisco-Manila route under flag of Pacific Mail Steamship Company.

To Be Oil Burners, Brooklyn, N. Y.—United Fruit Company steamers Carillo and Tivives are at plant of Robins Dry Dock & Repair Company for conversion.

Tanker Repairs, Fore River, Mass.—Bethlehem Shipbuilding Corporation is repairing steamer Clement Smith, of the Calvert Navigation Company, at price of $63,000 and 36 days' repairing under body, and $15,700 and 22 days for erecting new stern frame.

Overhauling Vessels, Oakland, Cal.—About 20,000 tons of Alaska Packer Fleet expected to be placed on the ways of the Moore Shipbuilding Company for general overhauling.

Repair Contract, Victoria, B. C.—Steamship Bessie Dollar awarded to Yarrows, Ltd., for repairs, $25,000 and 13 days.

Contract Award, Seattle, Wash.—British steamship Narenta severely damaged by grounding awarded Todd Dry Docks, Inc., $115,383 and 42 days.

Repair Activities, Newport News, Va.—Ships repaired here recently include Eastern Pilot and Standard Oil tanker J. A. Bostwick at Newport News Shipbuilding and Dry Dock Company, and Opria at Southern Yard.

Ship Overhauled, Brooklyn, New York.—United American Line steamship Dakotan awarded Robins Dry Dock & Repair Company for general repairs, $8,975 and 7 days.

Remodelling Gunboat, Newport News, Va.—Gunboat Nashville went to Southern Shipyard for conversion into 2,000-ton oil barge.

Barge Contract, Galveston, Texas.—Galveston Dry Dock Company awarded contract for reconditioning and repair of collision damage to Sinclair Oil Company barge, $41,500 and 60 days. Bids opened February 27 at New Orleans, La.

Big Repair Job, New York.—Shipping Board steamships American Legion and Southern Cross awarded Staten Island Shipbuilding Company for reconditioning. Total price about $144,750.

Plate Replacements, Buffalo, N. Y.—Buffalo Dry Dock Company active, recent jobs including renewals and repairs on steamers J. S. Ashley, W. P. Palmer, the Robinson, the Bedell, and the Newton.

Stern Wheel Steamer, Vancouver, B. C.—G. F. Askew reported to have order for stern wheel steamboat, 172 feet in length, for Hudson Bay Company service.

Hulls for Barges, Portland, Oregon.—Port of Portland reported negotiating with Shipping Board for purchase of three wooden hulls now lying in that harbor.

SHIPYARDS AND DRYDOCKS

Shipyard Closed, Clearfield, Md.—Plant of the Union Shipbuilding Company near Curtis Bay has been closed down and is in charge of caretakers. Company is owned by McClintock & Marshall, Pittsburgh, Pa.

Dry Dock, Elizabeth City, N. C.—Elizabeth City Iron Works, Riverside Ave., contemplates construction of a dry dock and marine railway in addition to machine shop.

Shipyard Sale, Bristol, Pa.—Shipping Board has placed plant of Merchants' Shipbuilding Corporation on sale. Yard has twelve shipways for building 400 foot steel ships and cost about $10,000,000.

Ship Repair Plant, Mobile, Ala.—Todd Shipyards Corporation, Wm. H. Todd, president, 25 Broadway, New York, plans construction of dry dock, shipbuilding and ship repair plant on recently acquired property on which plant of Mobile Shipbuilding Company was formerly located.

PORT IMPROVEMENTS

Pier, Weehawken, N. J.—Erie Railroad, 50 Church street, New York, has let contract to Foley Brothers, 209 Gilfillan Building, St. Paul, Minn., rebuilding one of four piers recently destroyed by fire; $1,000,000.

Pier, Bay St. Louis, Miss.—W. W. Hammons, Gulfport, Miss., has contract for construction of public ferry pier connecting Hancock with Harrison County.

Wharf, Etc., Miami, Fla.—Bakers Haulover Commission, J. C. Baile, chairman, will construct inlet or channel between Atlantic Ocean and Biscayne Bay, Dade County; about $250,000. Robert Crabtree, engineer.

Terminals, Portsmouth, Va.—City Manager Jervey contemplates construction of municipal terminals. U. S. District Engineer J. C. Oakes interested in project.

Wharf, Etc., St. Petersburg, Fla.—City plans improvements to Bayboro harbor, including deepening to 18 feet and building of 600-foot wharf. $100,000 bond issue contemplated. Address the Mayor.

Piers, Philadelphia, Pa.—Contracts for construction of Girard piers, to be built of concrete and to replace obsolete wooden structures, will soon be let; about $4,000,000.

Pier Extension, Tacoma, Wash.—Port Commissioners plan 400 foot extension to Pier 1, to limits of port property.

Harbor Works, Tampa, Fla.—The city will vote not later than May 2 on $600,000 bond issue for complete improvements on the Ybor estuary waterfront.

Improvements Sought, Gulfport, Miss.—State representative, Houston H. Evans, reported interested in an appropriation of $80,000 for harbor improvements.

Seawall, Greenville, Miss.—Delta Cement Tile Company awarded contract for construction concrete and steel seawall, $184,000.

Wharves, Orange, Tex.—City reported as having sold $240,000 bonds for construction and equipment of 800 feet of additional wharves.

Harbor Improvements, Houston, Tex.—The city has $26,440 available for improving and maintaining its harbor. Address the mayor.

Wharf and Ferry Building, Philadelphia, Pa.—Plans completed for two story ferry building and wharf at Larners Point for the Tacony Ferry Company to cost about $100,000.

Municipal Pier, Mich.—Village council at Grosse Pointe Farms, Mich., contemplates municipal pier to cost about $45,000.

GOVERNMENT WORK

Dredging, Nashville, Tenn.—War Department, Lieut. Col. J. R. Slattery, Box 900, will spend about $15,000 for dredging between municipal terminal and channel proper, Cumberland River.

Dredging, Philadelphia, Pa.—Delaware Dredging Company, Colonial Trust Building, has contract for dredging in Murderkill River and Inland Waterway between Rehoboth and Delaware Bays; $45,700.

Tug Boat, Washington, D. C.—Sealed proposals received until 10:30 A. M., April 17, for purchase of tug boat being offered for sale by General Purchasing Officer, the Panama Canal, Washington, D. C. Circular 1471.

Contract Awards, Washington, D. C.—Bureau of Yards and Docks, Navy Department, awarded contract to Wittenmeier Machinery Co., 650 North Spaulding avenue, Chicago, Ill., for installing refrigerating and cold storage plant at Naval Base, San Diego, Cal., at price of $29,970, and to General Electric Company, Schenectady, N. Y., for installation of motor generator sets and switchboard at Naval Base Hospital, Hampton Roads, at $16,860.

Specifications.—The following specifications have been available at or in contemplation by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for various work or material as listed below:

Hangar, Etc., San Diego, Cal.—Construction of hangar and oil storage house. Specification 4581.

Guardhouse, Etc., San Diego, Cal.—Quartermaster guardhouse and shops at marine corps. Specification 4582.

Equipment, Boston, Mass.—Installation of coal handling equipment. Specification 4583.

Radio Quarters, Sayville, N. Y.—Construction of radio quarters. Specification 4584.

Equipment, San Diego, Cal.—Installation of mess and kitchen equipment. Specification 4587.

Shed, New York City.—Construction of steel storage shed on Pier H. Specification 4589.

Wharves and Piers.—The United States Government Constructing Quartermaster is preparing plans for the construction of wharves and piers at Fort Mason, Cal.

Dredging Contract, Jacksonville, Fla.—J. C. Angier, Miami, Fla., awarded contract for dredging and rock removal at Sarasota Bay, Fla., $59,588.

Tugboat, Panama Canal.—General Purchasing Officer for Panama Canal will receive sale proposals at Washington, D. C., until 10:30 A. M., April 17, for purchase of one tugboat being offered for sale.

NEW INCORPORATIONS

Interlake Navigation Company, Ltd., Montreal, Canada; capital, $500,000; to own, operate ships of all kinds, wharves, docks and general transportation facilities and to carry on general navigation and forwarding business; W. W. Skinner, G. G. Hyde, J. F. Ahern, R. C. Grant and R. J. Forster.

Empire Shipping Corporation, Wilmington, Del., capital $100,000; to build, own and operate boats.

Glen Steamships, Ltd., has been incorporated under the Dominion Companys Act with $1,000,000 authorized capital and an office at Midland, Ontario, to carry on a business of transportation of merchandise, grain, coal and passengers; all land and water towing, wrecking, and salvaging in all its branches; to own and operate ships of all kinds, wharves, piers, docks, shipbuilding yards and general transportation facilities. The incorporators are James Playfair, president and general manager Great Lakes Transportation Company; D. L. White, D. S. Pratt, J. W. Johnson and F. W. Grant, Midland, Ontario.

The Monmouth Steamship Company, Ltd., has been incorporated under the Dominion Companys Act with $100,000 authorized capital, to own and operate ships, dry docks, shipping terminals and other transportation facilities, and to carry on a general navigation business. Office at Toronto.

FOREIGN ACTIVITIES

Minelayer.—Werf Gusto, A. F. Smulders of Schiedam, Holland, has launched a steel hull of the Dutch minelayer Douwe Aukes, which is under construction for the Royal Dutch Navy and which is the last of two such vessels under construction in that yard. The steamer will be provided with two triple expansion engines, two water-tube boilers and have a speed of 13 knots. She will be fitted with all modern equipment.

New Motor Ships.—The 14,000-ton motor ships Lochkatrine and Dinteldyk, for the Royal Mail Steam Packet Company and the Holland Amerika Line, respectively, were completed in February by Harland & Wolff. These ships inaugurated a new service to be developed by the steamship line between England, Dutch ports, and the west coast of North America. The vessels will be followed by four similar craft, all built especially for this trade by the same shipyard, two to sail under the flag of the Holland Amerika Line and two for the Royal Mail Steam Packet Company.

Program of Motor Ships.—Construction of motor ships abroad continues active. It is reported that the Glen Line program, now in hand, when completed will give a fleet of four 1,400-ton ships and about eight or nine vessels of 10,000 tons. The British India Company has a program of five motor ships of which only the first has been completed. Holts are building two motor ships, Furness, Withy & Company have recently taken delivery of their first vessel, and two more are on order, while Tankers, Ltd., will shortly be in possession of four motor tankers.

Maiden Voyage.—The motor ship Glengarry, the third 14,000-ton standard Diesel motor ship built for the Glen Line by Harland & Wolff was scheduled to sail on her maiden voyage from London on March 23.

Sea Trials.—The Doxford-engined motor ship Dominion Miller, the 9,300-ton vessel for Furness, Withy & Company, recently completed her sea trials. She is equipped with 3,000 indicated horsepower opposed-piston engines and averaged 12.2 knots on her trip. After completing her trials the ship left on her maiden voyage to Buenos Aires.

Southampton Harbor Dredging.—It is announced that the Southampton Harbor Board has accepted the tender of Messrs. James Dredging & Towing Company for the dredging of the swinging ground and the deep water channel, which work is being carried on with a view to the reception abroad of deep draft vessels engaged in the Transatlantic service. It is expected the work will be completed within four months.

Launching, England.—On March 1 a new steel-screw steamer was launched from the Southwick yard of Swan, Hunter & Wigham Richardson, Ltd., to the order of the Cork Steamship Company, Ltd., for their line trading between Manchester and Liverpool and Dutch and Belgium ports. The vessel is 290 feet in length by 42½ feet beam, and is designed to carry over 3,100 tons dead weight on a light draft of water. The ship will be propelled by a set of triple expansion engines, which with the boilers are being constructed at the Neptune Works, Newcastle-on-Tyne, of Swan, Hunter & Wigham Richardson, Ltd.

Repair Contract, Rotterdam.—The contract for repairing the steamship Turkestan, which stranded recently at Breaksea Point of the Bristol Channel, has been awarded to the New Waterway Shipbuilding Company, Rotterdam. About forty bottom plates were to be renewed. The steamer Fifetown, which stranded at the same place, was awarded to Robb & Co., Leith. Nearly a hundred bottom plates were to be renewed on the latter ship.

New Lighter, Holland.—Mr. G. Gammers, at Osoterhaut, has ordered from N. V. Scheepsbouwwerven v/h P., and A. Ruytenberg, Waspek, a river lighter with a dead weight capacity of 1,050 tons.

Tonnage Output, Clyde District.—Shipyards on the Clyde during the month of February launched only a small number of vessels, the total tonnage being only about a third of that launched in January. The output from February consisted of six vessels of about 20,500 tons, as compared with twenty-five vessels of 82,500 tons in February of last year. The total for the first two months of 1922 consists of 16 vessels of 79,000 tons.

Anchor Line Ships, Clyde District.—Three large passenger ships will go on the Anchor Line in the service between Glasgow and New York within the next few months. The Columbia is at present being overhauled at Glasgow in preparation for the opening of the service, and at the same time is being fitted for oil burning. The Cameronia, which was completed last year, has been refitted at Glasgow during the past two months. A third vessel, the Tuscania, is now being fitted out at Glasgow for the New York service beginning next June, while a fourth vessel, the California, now under construction in the yard of Alex. Stephen & Sons, Linthouse, is expected to be launched soon. Two other vessels, the Transylvania and the Caledonia, are also building, but completion has been delayed

New Crane, Scotland.—Swan, Hunter & Wigham Richardson, Ltd., have purchased from a Dutch firm an improved type of crane with a lifting capacity of 150 tons to replace the Titan, which sunk near Jarron Slake as a result of a severe gale on December 17.

Tyne Ship Repairing.—More activity in ship repairing on the Tyne is reported due to the greater demand for tonnage for the coal export trade.

Repair Contract, Liverpool.—The contract for repairing the Cardiff steamship Euterpe, 6,000 tons, which sustained extensive bottom damage through grounding on the Tuskar Rock, has been awarded Messrs. H. & C. Grayson, Ltd. About 60 bottom plates are to be dealt with, in addition to frames, etc., and it is estimated the work will take a month to five weeks. The steamer is at Cardiff at present.

Shipbuilding Wages.—It is anticipated that the ballot which is now being taken of the shipbuilding unions in Great Britain, on the proposals of employers to discontinue the war bonus of 26 shillings 6 pence (approximately $6.44 at the normal rate of exchange) in two stages, namely 16 shilling 6 pence ($4.00) on March 15, 1922, and the other 10 shillings ($2.43) at some later date to be arranged mutually, will disclose a hostile vote. The employers have intimated to the Union that in any event a cut of 26 shilings 6 pence will be made on March 15, and it is therefore anticipated that a complete stoppage in the shipbuilding industry will take place.

Ship Construction, Germany.—It is announced that prospects for German motor shipbuilding for the immediate future are decidedly better. At the opening of the current year several motor ships were on the stocks at various German shipbuilding centres, and anticipations are that before the year has expired, about ten motor ships of large size will have been completed and delivered. The greater number of these vessels are being produced by the Deutsche Werft Aktiengesellschaft, of Hamburg. Altogether, there are at the present time about 20 motor ships of large size known under construction at German yards for German account, the exact number not being known.

New Tanker Fleet.—Phero, the fifth of the 500-ton motor-tankers built to the order of the Anglo-Persian Oil Company, has been completed by Crichton-Thompson Company. In each vessel a 180 brake horsepower Kromhout surface-ignition oil-engine is installed.

Sailing Ship Being Converted.—The sailing ship Scala Shell, of 4,500 tons d.w., is being equipped in Holland with two 800 shaft horsepower Vickers submarine-type Diesel engines, to the order of the Anglo-Saxon Petroleum Company.

Motorship in Service.—The motorship Munsterland, sister to the Haveland, recently ran trials and started on her maiden voyage to the Far East. Both these vessels have high-powered German submarine Diesel engines, driving propellers through reduction-gears, and are owned by the Hamburg-American Line.

New Ship.—One of the most interesting orders of 1922 is that embodied in the contract just placed by Alfred Holt & Co., Liverpool, England, with the Scott Shipbuilding & Engineering Company of Greenock, Scotland. This consists of a twin-screw motorship of 400 feet length, 52 feet breadth, and 32 feet depth, to be propelled by two 1,250-shaft horsepower. Still combination oil-and-steam engines.

STEAMSHIP INTERESTS

If present plans of the Baltimore Steamship Company materialize, the company will operate steamers from New York, as well as from Baltimore and Philadelphia, to Glasgow and other United Kingdom ports. It is probable that the company may operate Shipping Board steamers from New York to Irish ports.

In anticipation of increased business between the United States and the Irish Free State, the Irish-American Line, 82 Beaver Street, New York, has been incorporated under the laws of Delaware with a capital of $500,000. The new company is reported to be negotiating for the purchase of two vessels for passenger and freight service.

According to McCormick, McPherson & Lapham of San Francisco, Cal., general agents for the Osaka Shoshen Kaisha, this Japanese company will soon inaugurate an around the world freight service to be known as the Calcutta-New Orleans Line. The vessels will make the trip in four months, and in order to maintain a monthly service, four vessels will be operated.

A. H. Bull & Company of New York, have announced a new direct service between Boston and ports on the West Coast of Africa. There will be monthly sailings. C. H. Sprague & Son are Boston agents for the line.

The Norton Line, through its general agents, Norton, Lilly & Company, announces a reduction in passenger fares for the steamship *Crofton Hall,* sailing April 25 for Montevideo and Buenos Aires. Rates for Montevideo are from $225 to $500 and for Buenos Aires $250 to $525. The *Crofton Hall* carries first class passengers only.

Latest indications at Tacoma, Wash., are that the Nawsco Line will enter the passenger trade with several vessels that this line has been considering. These contemplated craft will be combination freight and passenger ships.

The United States Lines have announced the installation of one-cabin service between New York, Queenstown, Cherbourg, Southampton and London to be inaugurated with the sailing of the *Panhandle State, Centennial State* and *Old North State,* these ships to be shortly augmented by two others. The conversion of these "State" vessels for the new service involves merely the addition of two berths above the present hotel beds, thus giving accommodations for four instead of two persons.

According to the International Mercantile Marine Company, a direct service between Germany and Canada will be instituted this Spring with the sailing on April 23 from Halifax of the third-class liner *Vedic* for Bremen. Later sailings of vessels in this new service will be made from Montreal.

BUSINESS NOTES

The Pyle National Company announces that Mr. J. D. Sarles, of the marine department, will have temporary headquarters, until further notice, at Hotel Chelsea, 23rd Street and Seventh Avenue, New York.

The Wager Furnace Bridge Wall Company, Inc., announces the removal of its offices at 149 Broadway, New York, to new and enlarged quarters at the plant, 108-110 Academy Street, Jersey City, N. J.

The Dollar Steamship Line has announced the removal of its offices from 44 Whitehall Street to the International Commerce Building, 11-15 Moore Street, New York.

The Luckenbach Steamship Company, Inc., has announced the opening of an office in the Board of Trade Building, 131 State Street, Boston, Mass., in charge of K. E. Hurlburt, acting local manager.

The present Board of Directors of The Norwalk Iron Works Company, South Norwalk, Conn., announce a number of changes in the executive personnel of the organization. The executive staff is now as follows: C. L. Thompson, president and general manager; Howard E. Adt, first vice president; Harold B. Knowles, treasurer and asst. secretary; Thomas M. Steele, secretary; A. R. Betts, vice-president in charge of sales; W. E. Mathews, vice-president in charge of manufacturing and engineering; G. W. Wardwell, chief engineer; W. M. Greene, general supt.

The firm of Cox & Stevens, naval architects and marine engineers have moved their offices from 15 William Street to 25 Broadway, New York.

The Sun Shipbuilding Company, with its subsidiary, the Opposed Piston Oil Engine Company, of Chester, Pa., announces the opening of their New York office, Room 710, Cunard Building, 25 Broadway. The company is engaged in the construction of all types of vessels, ship repairs and dry docking, and the re-engining with steam or Doxford Diesel engines.

The Diamond soot blower business has been purchased by new interests in the form of the Diamond Power Specialty Corporation of Detroit, Mich., a new company which has taken over the business and plant of the Diamond Power Specialty Co., co-partnership, the members of which are retiring from the soot blower business in the Western Hemisphere. Norman L. Snow, president and treasurer of the new company, resigns his position as vice president and active head of the Terry Steam Turbine Co. of Hartford, Conn., with which he has been connected for the past thirteen years.

TRADE PUBLICATIONS

Gasoline Power Units.—The Buda Company, Chicago, has issued bulletin No. 388, describing a four-cylinder gasoline power plant, which it has recently developed for use in driving electric generators, arc welding sets, triplex or other types of pumps, hoists, concrete mixers, air compressors and for similar uses in machine shops, etc.

Generator Cooling Apparatus. — The B. F. Sturtevant Company, Boston, Mass., has issued Bulletin No. 246 describing and illustrating in detail its generator cooling apparatus. A psychrometric diagram showing the percentage of relative humidity has also been included in the bulletin which contains 27 pages.

Pipe Machines.—Stoever pipe machines for cutting and threading steel or wrought iron pipe are illustrated and described in a neatly arranged booklet of 16 pages recently issued by the Treadwell Engineering Company, Easton, Pa.

Cutting Torches.—The Air Reductions Sales Company, New York, features its type "D" cutting torch in a new folder now being distributed. In addition to an illustrated description of the torch, the leaflet contains tables of metal thicknesses that can be cut, oxygen and acetylene pressures necessary and the gas consumption in cubic feet per hour when using tips adapted to steel, cast iron or rivet cutting.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander J. S. Evans, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Draftsmen
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia
Via Carlo Alberto 18, Genova.

Marine Engineering
and Shipping Age

Volume XXVII May, 1922 Number 5

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
S. M. PHILLIPS, Associate Editor L. S. BLODGETT, Associate Editor
W. Z. GARDNER, News Editor

Contributing Editors

Rear Admiral C. W. Dyson, U. S. N.
Commander S. M. Robinson, U. S. N.
Professor C. H. Peabody
Captain C. A. McAllister, U.S.C.G. (Retired)
William Gatewood
H. McL. Harding
William T. Donnelly
James L. Bates

WE GUARANTEE that of this issue 5,550 copies were printed; that of these 5,550 copies 4,149 were mailed to regular paid subscribers, 337 were provided for counter and news company sales, 216 were mailed to advertisers, 27 were mailed to employees and correspondents and 821 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 27,350—an avrage of 5,470 copies a month.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

A Prophecy

THE Merchant Marine Act of 1922, with its direct and indirect aids will become a law during this session of Congress for the following reasons: The country is sold on the proposition of an American merchant marine; the necessity for the immediate adoption of a definite shipping policy which will induce private capital to invest in American vessels by giving American ships a chance to compete with foreign vessels on all fours is apparent; sufficient demand, which is as essential as necessity when legislation is to be secured, exists; the bill itself has been worked out on such a conservative and comprehensive plan for encouraging shipping, while at the same time safeguarding the Treasury, that no one has been able to accept the President's invitation to suggest something better.

That the country is sold on a merchant marine is evident from the public endorsements that the Shipping Bill has received from chambers of commerce and trade organizations in the South and Middle West. The testimony of representatives of these organizations who attended the hearings at their own expense for the purpose of informing Congress of their sentiments shows that the country is determined to preserve the trade routes that have been established by the Jones Act. They want a guaranty that American vessels will be kept on these routes for at least five years, and they never again will be willing to risk a congestion in transportation by depending on foreign ships for the carriage of their surplus products.

The necessity for an American merchant marine which Congress recognized in the preamble of the Jones Act when it promised to do whatever was needed to establish American shipping on a basis that would serve the country adequately in peace and war has been acknowledged even by such subsidy opponents as Senator Fletcher. Senator Fletcher stated in an address before the convention of the National Merchant Marine Association that he would support the Shipping Bill, if he could be shown that a subsidy was necessary in order to establish an American merchant marine. The democratic members of the Senate and House committees on merchant marine affairs are cross-examining witnesses in a very exhaustive manner, perhaps in the hope of delaying action until they can make alternative suggestions, but yet fully realizing the fact that a definite shipping policy will have to be adopted.

The demand for this legislation is indicated by the change in editorial policy of several influential Middle West newspapers, by the earnest efforts of 14 States to secure an outlet from the Great Lakes through the St. Lawrence River, by the determination of the Mississippi Valley Association representing 28 States to secure an outlet for agricultural products through the Gulf, by the growing realization of the importance of the merchant marine as a naval reserve and by the efforts of the President himself whose fondest wish is to establish the merchant marine in his administration.

British Propaganda

IT is the firm belief of a great many men of unquestionable integrity that active British propaganda is constantly at work to prevent the proper development of an American merchant marine. This is a fact, and it is chiefly due to the character of the shipping editorials appearing in a large percentage of the American press and notoriously many of those of New York city which have consistently opposed any constructive legislation that would establish our merchant fleet on a profitable basis.

On many occasions the *New York Journal of Commerce* has been open to suspicion on this account but the editorial recently appearing in their columns entitled "Government and Shipowners Incorporated" exceeds in *inaccuracies* and attempted sarcasm anything that has come to our attention. One would think that, if London papers could interpret the Shipping Bill in March, the *Journal of Commerce* ought at least to be able to do it in April, especially in view of the

able analyses that Mr. Lasker and others have publicly made and which have been literally broadcasted to the press.

This editorial in referring to subsidies says, "It is intended to pay subsidies to vessel owners, who will then carry on business as best they can. In the event that they are successful in making profits above 10 percent, one-half the surplus will constitute a repayment to the subsidy fund. In order to establish the conditions under which the shipping business is carried on, there is thus necessitated an extensive system of accounting and reporting, with allowance for depreciation and the like. This is obviously essential, if there is to be avoidance of concealment of profits or error in the reporting of apparent losses. Such a system of accounting and reporting would require clearly as elaborate a method of segregation as would be essential in any private business."

To comment on this for the benefit of our readers, we take pleasure in explaining to the *Journal of Commerce* that the profit a ship operator makes in excess of 10 percent will be determined by his *income tax return* which will have to be made and audited, subsidy or no subsidy. Chairman Lasker has repeatedly explained that the few hundred ship operators' returns ought not to embarrass the Treasury department who are handling far more complicated questions than checking a ton mileage subsidy with a net income statement. As there is very little likelihood of many, if any, companies making over ten percent, it would appear that there is no occasion to worry about the reliability of the income tax returns. If there is, we have failed to note any anxiety from the press about the taxes that the Government may be losing through the possibility of millions of income tax returns being incorrect. It is conceded that a small number of reporters will be needed to determine the subsidies to be paid by multiplying a fixed speed times a fixed tonnage times a fixed distance at a fixed rate.

The next statement made in this editorial relates to loans to shipowners and it reads as follows: "Obviously, if the Government should go into such an enterprise, it would be a kind of special partner. It would in the first place be a large creditor of the buyers of vessel tonnage, who are expected to purchase on perhaps 15 years' credit. Since the loans are to be made at a nominal figure of possibly two percent either for the carrying of the unpaid sums due on the ships or for furnishing working capital (where that is allowed), the Government will of course have very scant security and will find it needful in any case to keep close track of the methods of operation."

In commenting on this, we utterly fail to understand how our esteemed contemporary, if it has actually taken the trouble to read the proposed law, *could mix up the construction loan fund with the sale of existing vessels and unpaid balances.* In this case, for its information, the proposed law only allows money to be loaned at 2 percent when it is to be used in the construction of special types of vessels, such as passenger vessels, refrigerator ships or motorships which are sorely needed to balance the fleet. Mr. Lasker testified before the hearings that he would not sell the Government vessels without a substantial payment down and that the unpaid balance would draw a commercial rate of interest. Where does the scant security come in on selling vessels at about $30 on such a basis?

After indulging in a few pessimistic inferences regarding the future of the American merchant marine, this patriotic expounder of our shipping policy enumerates what it calls the adventitious (accidentally or casually acquired) indirect aids. It then expresses great concern as to the possible effect that the carrying out of such policies would have on other nations.

The *Journal of Commerce* knows that the Shipping Bill was prepared from the facts and findings of well known marine experts working in conjunction with the Shipping Board. It must also be aware that when the President outlined the exhaustive and comprehensive nature of this proposed legislation, he said if anyone has criticisms to offer of this plan *they should at least suggest something better in its stead.* How then can a daily newspaper supposed to be serving the shipping interests, forty-nine days after the Shipping Bill has been introduced into both Houses of Congress, publish an editorial 16½ inches long without one constructive suggestion and sarcastically criticise the provisions of this bill by basing its logic upon inaccurate statements of the intent of the proposed legislation? This may not be British propaganda but it certainly is not American.

American Marine Association Active

THE American Marine Association, born some fifteen months ago and at the beginning known as the Marine Equipment Association of America, has made rapid strides as a factor in the marine field. Originally it was intended that the chief function of the organization should be to stage an annual marine show; but by degrees its scope has broadened until now it is rapidly assuming the proportions of a chamber of commerce.

The first definite step toward the present goal was taken last year when the association decided to hold its initial exhibit during the week in which the Society of Naval Architects and Marine Engineers held its annual meeting and succeeded in enlisting the hearty cooperation of that organization, which it still enjoys. This was followed in turn by agreements on the part of the American Society of Marine Designers and American Steamship Owners' Association to participate in the efforts of the American Marine Association, made last November, to inaugurate "American Marine Week;" while the Technical Committee of the American Steamship Owners' Association gave its approval by visiting the marine show in a body. Efforts are now being made to enlist the support of other similar bodies.

Following the first get-together in November, the American Marine Association immediately took steps to capitalize its work by revamping its committees, opening a permanent office in New York and renting two floors of the Grand Central Palace for its second annual exhibition (November 4-11), for which it has already booked considerable space. During these activities the association has found time to carry on a campaign for increased membership and perfect arrangements to help to stimulate public interest in the subject of an American merchant marine.

In connection with the last mentioned activity, the association has endorsed President Harding's plan and is taking steps to make its action known to Congress. The opinion

of the American Marine Association will undoubtedly have considerable weight with those charged with enacting legislation that will mean much to American shipbuilding and shipping, since its membership includes substantially all of the large and many of the smaller American concerns having to do with building and repairing ships and manufacturing the things with which ships are equipped, as well as a number of steamship operating companies whose vessels fly the American flag.

The Proposed Pacific Steamship Combine

ACCORDING to Mr. Lasker's testimony at the hearings on the Shipping Bill, the real object of the board, in suggesting at the time that it did to the shipping and financial interests of the Pacific Coast that a steamship combination having a capital of at least from $25,000,000 to $30,000,000 should be formed to meet the competition of the strongest companies of other countries, was to obtain data and facts from men representing the wealth of the Pacific Coast which could be recited to Congress and which would show a definite case where the passage of the proposed shipping legislation would bring immediate results.

The fact that a group of representative men could be induced to travel across the country to Washington to confer on the possibilities of a shipping combination of this sort, knowing, of course, that it would be several months before a definite shipping policy could be established, ought to be a practical assurance to the American people that results can be obtained.

There are several reasons why the Pacific offers exceptional opportunities for a large company operating combined passenger and cargo ships, provided the President's plans go through. Principally among these are the proposed diversion of the Army transport service to private vessels and the extension of the coastwise regulations to include the transportation service to the Philippines.

At any rate the committee from the Pacific Coast was so much impressed with the possibilities of a great American steamship line on the Pacific that its members were disappointed that the Shipping Board could not make them a definite proposal at the time. The board, however, obtained its object, for the committee voluntarily averred that it would go ahead and form this big steamship company, if the proposed legislation or approximately the proposed legislation is enacted by Congress. They are entirely disinterested, if it is not.

Insurance Syndicates Report

CONSIDERING the depression in business, the fall in tonnage values and the increased competition of foreign companies, the annual statement of the American Marine Insurance Syndicates is very satisfactory. Although Syndicate "B" has done very little business, due to the inability of the Shipping Board to dispose of its vessels, it reports a credit balance of $477,066.74.

The scope of Syndicate "B" is limited to insuring the unpaid balances on Government ships and these vessels cannot be sold except at very low prices, which complicates the question of making good the cost of repairs. In addition to this, the managers have recently agreed that "where a private owner's interest is written in Syndicate 'C' the same rate will be quoted in 'B' for the Government's interest;" where a private owner's interest is placed with underwriters other than "C," Syndicate "B" will quote for the Government's interest the same rates as would have been quoted for the owner's interest if insured with Syndicate "C"; and "that all obligations to place such insurance with 'B' being suspended and the Government and owners being at liberty to place the insurance in the world market if so decided in each case by the Shipping Board."

Syndicate "C" reports a credit balance of $1,251,597.35 which, in view of business conditions, reflects very efficient management. In one instance, the fact that the managers refused to meet the market on the terms offered for insuring the *Northern Pacific,* whose total insurance amounted to $1,250,000, resulted in the absorption of the total loss by foreign companies.

Syndicate "A," or the United States Salvage Association, reports the practical completion of a world wide organization having agents at 88 ports. The work of this syndicate in making damage surveys, assisting in salvage work and other functions similar to those practiced by the London Salvage Association, should be of great benefit to our merchant marine as well as marine insurance companies.

Keep the Navy Properly Manned

THE United States was able to call a Disarmament Conference and to succeed in getting the principal maritime powers to make a treaty ending the mad race for naval supremacy simply because it had an efficient Navy and the potential power of increasing the number of its warships far beyond that which any other nation could do without involving itself in serious financial difficulties. If America had not been powerful on the sea or if she had not been able to sacrifice much more than any other country in the way of naval strength, it is very doubtful whether this long step toward the attainment of a permanent peace could ever have been accomplished.

Why, then, after telling the world that a certain tonnage of capital ships represents an irreducible minimum that this country cannot safely go below, should Congress attempt to reduce the naval personnel to 67,000 when it was stated at the time of the conference that 130,000 men were required to efficiently man our ships on the so-called 5-5-3 ratio? At this writing the House has increased the number of men to 86,000 which is no more nor less than a compromise. As the personnel has to do the fighting an adequate number of trained men is more important than a paper figure of displacement tonnage. Does Congress wish to create the impression that we are going to scrap our Navy anyway, that we made no sacrifice in giving up our best ships, and that other countries have been inveigled into an agreement, our part of which we intended to do notwithstanding the result of the conference?

If such is the case, our legislators certainly do not realize the fact that the Limitation of Armament agreement is only

an experiment at the best. All thinking men know that the danger of war is not passed but simply reduced. They know that the best insurance not only for this country but for the world against a recurrence of armed conflict lies in the United States preserving a strong influence, backed by reasonable naval power which can be exerted in the proper direction when critical situations arise, as they surely will.

Financing and Expanding Our Foreign Trade

FINANCING and expanding our foreign trade, which will be the principal theme at the ninth National Foreign Trade Convention to be held at Philadelphia, May 10, 11 and 12, is of even more importance to the welfare of our merchant marine than the passage of the shipping bill.

The shipping bill will equalize the differential existing between the cost of operating American and foreign ships but it will not provide the cargoes that must fill these vessels if they are to be profitably employed.

Fortunately, however, America can easily produce more than enough to fill even our surplus cargo ships and by so doing it could increase the purchasing power of our citizens so that they could import an ever increasing amount of the products of other nations.

Just as a man who is able to successfully direct a business enterprise that gives profitable employment to a large number of people is a public benefactor, so America could, by financing and expanding its foreign trade on sound business principles, furnish an opportunity for other nations to increase their production, develop their industries and improve their standard of living.

The loss of productive and purchasing power of the several million men who were slaughtered in the world war was a terrible blow to the world's economic structure, but that cannot be helped now. What can be helped on our part is a restriction of production to domestic needs with its consequent unemployment, reduced purchasing power and inevitably lower standards.

It is to be hoped that the Foreign Trade Convention will find a solution of the problem of European credits. Several schemes have been proposed and constructive legislation in the Edge Act has been accomplished, but there remain in South America and the Orient enormous opportunities that have as yet only been scratched.

Japan has spent vast sums of money in this country, which has been of mutual benefit. The insistence of our statesmen that the policy of the "Open Door" shall be maintained is sufficient proof of the value and possibilities of this market. Until the standards in the Orient have been raised to somewhere near our own level the only reason for over production is the lack of brains and courage to direct the development and resources of such countries as China so that the purchasing power of her citizens will be sufficient to allow them to avail themselves of what we consider the necessities of life.

This means the establishment of foreign merchandizing and banking branches on a firm footing and this must be accomplished, if a real merchant marine is to be established and an outlet for our surplus agricultural and manufactured products maintained.

Shipping Board Experts Who Prepared the Ship Subsidy Bill, the Basis of President Harding's Message to Congress and the Legislation Now Pending

Back row, left to right—Rear-Admiral H. H. Rousseau, U. S. N.; Winthrop L. Marvin, vice-president and general manager, American Steamship Owners' Association; John Nicolson; Captain E. E. O'Donnell; T. H. Rossbottom; Daniel H. Cox. Front row, left to right—Captain Irving L. Evans; Rear-Admiral C. S. Williams; Meyer Lissner, commissioner United States Shipping Board; Albert D. Lasker, chairman United States Shipping Board; Elmer Schlesinger; N. B. Beecher; J. B. Small, R. T. Merrill and Dr. S. S. Huebner.

Let's Have Protection All Along the Line

By Winthrop L. Marvin

Protection, vigorously applied and adhered to, has made the United States the greatest manufacturing nation in the world. It has the power —as our foreign rivals know full well—to make the United States the foremost ocean shipping nation as well.

It is well that President Harding's new Shipping Bill comes forward in a Congressional session that is called on to enact also a new protective tariff. This serves to emphasize the fact that national aid is not asked alone for our ocean shipping industry.

What the protective policy has proved to be for manufacturing and for agriculture the Shipping Bill, with its indirect aids and direct compensation, or subsidy, will also be for shipowning and shipbuilding. The two measures naturally and logically go together.

The First American Tariff Protected Shipping

In fact, the very first protective tariff in American history —the law of July 4, 1789, the first law under the Federal Constitution—gave powerful aid to ocean shipbuilding and navigation along with all other American industries of the day. That law fixed a substantial rate of import duty upon virtually all kinds of foreign merchandise, and protected the shipowners, shipbuilders and seamen by a provision that there should be a higher duty by 10 percent on these foreign goods in foreign ships than if imported in American vessels. Furthermore, there was a tonnage tax of 50 cents on foreign and 6 cents on American vessels which gave additional encouragement to the new American merchant marine.

It is a matter of history that this early provision for the protection of shipping and shipbuilding was brilliantly successful—more successful, measured by its actual results, than was the protection simultaneously given to manufacturing and to agriculture. Our tonnage registered for foreign commerce, which was only 123,000 in 1789, had risen to 981,000 in 1810, when we were carrying 90 percent of our own imports and exports in our own ships.

Shipping Our Only Unprotected Industry Since 1861

It is one of the strangest anomalies of legislation that when the Republicans, newly come to power, vigorously reestablished the protective tariff system in 1861 and onward, so far as manufacturing and agriculture were concerned, they did not at the same time extend protection to American shipping. But they did not, though after the war they repeatedly attempted to through various subsidy bills and other expedients. They long found the Democratic party almost solidly opposed to them, together with a faction of Middle Western Republicans, particularly those of German and other foreign descent.

Such protracted Congressional hearings as those before the present joint committee always create an impression that the shipping question is an exceedingly subtle, complex affair. But it is no such thing—as a matter of fact, it is a singularly direct and simple proposition. Ocean shipowning and shipbuilding have not shared the prodigious increase which other American industries have manifested since the Civil War, because ocean shipowning and shipbuilding have been left unprotected—the only unprotected industry of all the range of American industries exposed to foreign competition.

Because of intensive competition, due to the rivalries of maritime governments and peoples, there has actually been more need of protection to the ocean shipping industry than to any other. Yet it has been left on what is virtually a free trade basis. That is to say, except for a few transient mail subsidies to special lines, the American merchant marine in overseas trade has been operating since 1860 without any protection whatsoever, of any kind. There has been no tariff protection and there has been no adequate, sustained subsidy protection that might serve as a substitute.

American People Unwittingly Supporting Foreign Naval Reserves

On the other side, however, among our foreign competitors the ocean shipping industry has been sedulously fostered as has nothing else. Our foreign rivals know well the advantage to them of absolute control of the overseas delivery service of American manufacturers and farmers. They know that the nation which owns the ships has the power to repress American commerce, and that in the long run this is exactly what it will be doing. They know also, these foreigners, that if they can manage to do with their own ships the bulk of our overseas carrying, they are really making us, the American people, support foreign naval reserves that can be turned with deadly force against us in an emergency. This is sufficient to explain the ferocious opposition always offered by various foreign elements in this country to any measure for the upbuilding of a great American merchant marine.

Never before since 1789 have a protective tariff bill and a protective shipping bill been offered together at once for the action of Congress. Never before has it been made so embarrassing for an inland Senator or Representative to vote on one day for a tariff for the encouragement of sheep growing or of wheat growing or of corn growing or of livestock or of dairy products, and then on the next day to vote against a protective shipping bill. It is altogether a very awkward situation for those lawmakers of the interior who have been invoking protection for the benefit of their constituents and have attempted to deny it to the merchant marine.

Opposition of the Agricultural Bloc Broken Up

It is a recognition of this fact that has broken up the anticipated opposition of the agricultural bloc to President Harding's merchant marine bill, on which foreign shipowners and governments were counting with so much exultation. There is a sense of humor as well as a sense of justice among rural as well as among urban Americans.

The basis for protection to the merchant marine is exactly the same as the basis for the protection of manufacturing and agriculture. American wage costs and living standards are higher than those of the Old World. It is this in the last analysis that compels the maintenance of a protective policy in the United States. Our workers expect and need to earn more money to live as Americans should live. Shipowners have to vie with manufacturers and farmers for their workers in the labor markets of our ports and country. It is this hard economic fact far more than the La Follette seamen's law that compels a higher operating cost of American ocean steamers.

A New Form of Customs Tariff

If ocean shipping could be protected by a customs tariff, there is no doubt whatever that American shipping would

have been a well-protected industry in all the years since 1861. But both President Wilson and President Harding have agreed that there are grave reasons of state why the thirty-odd commercial treaties forbidding tariff aid to American ships should not be disturbed by efforts for amendment. Therefore, it has proved absolutely necessary to resort in the present Shipping Bill to a different method of assistance, which, however, is not so different as it may seem to be. As President Harding declared in his address, referring back to the discriminating duties of the Merchant Marine Act of 1920, "The recommendation of today is based wholly on this commendable intent of Congress. The proposed aid of the Government to its merchant marine is to have its chief source in the duties collected on imports. Instead of applying the discriminating duty to the specific cargo, and thus encouraging only the inbound shipment, I propose that we shall collect all import duties, without discrimination as between American and foreign bottoms, and apply the heretofore proposed reduction to create a fund for the Government's aid to our merchant marine. By such a program we shall encourage not alone the carrying of inbound cargoes subject to our tariffs but we shall strengthen American ships in the carrying of that greater inbound tonnage on which no duties are levied, and, more important than these, we shall equip our merchant marine to serve our outbound commerce, which is the measure of our eminence in foreign trade."

It was the original intent of Congress two years ago to aid American shipping by diverting 10 percent of the customs duties to encourage shippers to prefer American ships. President Harding is absolutely right when he urges that there is no essential difference between diverting 10 percent of the customs duties from the Federal treasury and paying out 10 percent of the customs duties for the purpose of direct encouragement of shipping. This is a proposition to which no reply has ever been made because none could be. The cost of either policy is the same to the American nation. Both embody protection to the overseas shipping industry as a whole.

Quibbling Over the Principle of Subsidies Unnecessary

It is full time that there should be an end forever to abstract discussion of the principle or policy of subsidies. There is no discussion of it whatever by any other nation than our own. Other governments and other peoples, if they wish to protect their merchant marine and naval reserve, go about it in straightforward, manly fashion, without sectional or party division. If it is necessary for them to pay a certain sum of money from the public treasury for the maintenance of a national line of steamers to South America or the Orient, they go ahead and do so without quibbling. If it is necessary and advisable to encourage "tramp" steamers by mileage-tonnage subsidies, these other governments and peoples do so, as notably in the case of France and for years in the case of Japan. They see what they want and believe they need, and they go after it with a precision and an honesty that shame the hair-splitting politicians of America.

American Railroads Built Up by Government Aid

What is the use of attempting to deny or hide the fact that most of the American railroads of today were built by the potency of public aid administered at a time when the public could not afford it half so well as it can today? Without that aid the greater part of our magnificent railroad system would still be non-existent. A dozen years ago a rural newspaper of the West aroused much amused comment in Washington. In parallel columns this rural sheet printed two editorial leaders—one passionately championing the grant of a municipal cash payment to aid the building of a railroad line to a neighboring city, the other violently assailing President Roosevelt's recommendation of a subsidy for American ships on the Pacific and to South America. The ship subsidy was denounced as vicious; the railroad subsidy was eulogized as beneficent and holy. Of course they were both essentially the same thing.

In the long line of successive efforts to secure subsidy in this country for American shipping, there has been just one serious scandal—that associated with the postal subsidy to the old Pacific Mail Company a half century ago, in 1872. This is harped upon today by the foes of shipping subsidies—and most notably of all by the foreign foes—as an argument against the granting of shipping subsidies in this year of grace 1922.

Very much less than fifty years ago—perhaps twenty years ago—there was a scandal in connection with the expenditure of public funds for certain harbor improvements in Savannah. But what would be thought of the logic or the sanity of a statesman who should now uprear himself in the halls of Congress and cite that Savannah episode as a cogent argument against the enactment ever thereafter of any and every bill for river and harbor improvements?

Subsidy Opponents Closely Identified with Foreign Steamship Companies

Yet the argument in the one case is worth just as much as it is in the other—and no more. It is an undeniable fact that most of the vociferous talking in America against subsidies to the American merchant marine has always been done by interests more or less closely identified with foreign steamship companies. Just now the lower part of the city of New York—the maritime district of New York—is infested by a great many individuals loudly protesting against any national aid to the American merchant marine—and it is a fact that almost invariably these individuals speak with a pronounced North European accent.

These gentry sometimes adopt other strange and reprehensible methods. The late Senator Gallinger of New Hampshire, than whom no more courteous or honorable gentleman ever lived, was accustomed to find in his mail from time to time letters, always anonymous, denouncing him for his leadership of the movement for American shipping—and all these brave missives bore the postmark of some station in the lower part of New York City, then dominated almost wholly by European steamship offices. Argument by vituperation has, significantly, always characterized both the foreign and domestic enemies of protection to American shipbuilding and navigation. The average anti-ship subsidy editorial alike in New York and on the other side of the Atlantic usually reads as if it were written in the spirit of the common scold.

But it will take something more than these characteristic methods of obstruction this time to check the victorious progress of the present aggressive national movement to bring our ocean shipping interest within the circle of American protected industries. Protection vigorously applied and adhered to has made the United States the greatest manufacturing nation in the world. It has the power—as our foreign rivals know full well—to make the United States the foremost ocean shipping nation.

Noted Mining Engineer Advocates Shipping Bill.—Prompted by many years' study of the subject both at home and abroad, John Hays Hammond, the eminent mining engineer, has wired to Chairman Lasker of the Shipping Board his appreciation of the efforts being made in the behalf of an American merchant marine. "It is regrettable," he said, "that our people do not fully realize the inter-dependence of every class of the community and every section of the Union and that an American merchant marine is indispensable for our export trade upon which the prosperity of all our industries depends."

Ask Your Congressman to Support the Shipping Bill

Hearings Under Way—Endorsement of Congressional Committees Expected—Ultimate Victory Certain But Don't Stop Working Until the President Signs the Bill

By "Old Scotch"

As they say in racetrack parlance, "They're off!" The "they" in this instance doesn't refer to horses but to our solons in Washington. After much preliminary training and several false starts, the long promised hearings on the Administration's subsidy bill, the Magna Charta of American shipping, were begun on April 4.

An auspicious start has been made, inasmuch as the very unusual procedure was adopted, in the case of this measure, of holding joint hearings, that is, the members of the Senate Committee on Commerce and the House Committee on Merchant Marine and Fisheries sit around the same table, thus affording the witnesses the opportunity of addressing both committees at the same time. This will not only save the time of the Shipping Board experts, but it will reduce the time usually taken at hearings of like character by at least half. The chairmen of the respective committees, Senator Jones and Representative Greene, alternate in presiding over the joint committee.

A Bouquet for "Uncle Billy"

Speaking of "presiding," it is a cause of wonderment to see the able way in which that veteran statesman, "Uncle Billy" Greene as he is affectionately known to his colleagues, can wield the gavel and keep things going in a parliamentary manner. Mr. Greene has been in Congress nearly thirty years, and is now 82 years of age. During his long and honorable period of service in the national legislature he has devoted much of his time to problems of the merchant marine, and throughout his entire career has been the staunch friend and supporter of our merchant marine efforts. Both he and Senator Jones can always be relied upon to champion all legislation of a constructive nature, which comes to their committees.

At this writing, the discussion has progressed far enough to see that, barring unforeseen circumstances which may arise, there is a grim determination on the part of the proponents of the bill to give it the favorable endorsement of both committees. In all probability by the time this edition of Marine Engineering and Shipping Age is brought out the bill will be out of committee, and on the calendars of both houses, ready to be taken up for passage. Visitors at the White House have frequently stated in the public press that President Harding considers this measure the most important of all pending legislation, and is using every effort possible to secure favorable action.

Opposition From Our Foreign Rivals

While ultimate victory seems assured, we must "not fool ourselves," a term Chairman Lasker often uses in his testimony, that there will not be much opposition. Our rivals on the ocean are taking a very deep interest in the whole procedure, and view the whole proposition with alarm. Already certain European periodicals are printing lugubrious editorials of the terrible effect the passage of the bill will have on their own shipping, and even going so far as to threaten all kinds of reprisals. They are a very resourceful bunch, and we will have to be on the watch for the working of very subtle propaganda right in our own midst. Evidences of it are already apparent both in Congress and outside in the daily press.

The opposition thus far has centered among several southern congressmen, who are making things lively for the subsidy advocates who have thus far appeared as witnesses. They are no mean antagonists and, while no one doubts their patriotism, it is very hard to follow the reasoning of their antagonism. It is the opposition of other and more subtle influences, fostered by criticising journals, which is the most to be feared.

Facts are stubborn things to overcome and the advocates of the measure are loaded with many which cannot well be controverted. Much will depend upon how these facts are presented as to their ultimate effect on our legislators.

Circumstances Alter Cases

I think it was in an old copy-book that I first saw the maxim "Circumstances alter cases." In any event it is very applicable to the present discussion. While only two years ago, if any of us had even suggested that some of our best cargo vessels in the Government fleet would be offered for \$30 a deadweight ton, he would have been thought crazy. Now, however, where freight rates have been cut to one-quarter of the terms then being offered in a teeming charter market, it is somewhat difficult for a ship that cost around \$200 a ton to even make a living. The prevailing rate of \$30 per ton hardly gives them a chance to compete with similar priced vessels of our rivals, in view not only of the greatly depressed rates but of the scarcity of goods that are moving over the ocean highways.

You can't sell snowshoes in July, nor linen dusters in January: no more can you sell ships when there is no demand for them. But just as surely as the seasons roll around, and make markets for snowshoes and linen dusters, will the conditions change and shipping once more be a going and a profitable business. It is for such conditions that we must make preparations, and the passage of the subsidy bill is the most vital of these necessary steps of preparedness.

Revival of Market for Ship Tonnage Predicted

The Chairman of the Shipping Board stated that, in his opinion, it would take 2½ years before they could dispose of any considerable amount of the Government tonnage, even if this bill passes. I am more optimistic than that, and will predict that with the gradual resumption of business activities now going on, and with the aid of this subsidy measure, there will be many ships disposed of in half that time. We must remember that with only one-third of the Government tonnage in use at the present time, we are carrying less than one-third of our outgoing and incoming ocean business. With the gradually increasing amount of goods to be carried, and the increase of the percentage carried in American bottoms, which must follow the passage of this legislation, there will be a very lively demand for ships.

In anything approaching normalcy in world conditions, Uncle Sam ships out of this country about 45,000,000 long tons of cargoes over salt water, and imports 35,000,000 tons over the same routes. That makes 80,000,000 tons of ocean freights to be carried. If we get only half of our own business, the amount we are aiming at for our own ships, we will have to utilize a great many more cargo vessels than we are now employing. Nor must we forget for a moment the

$250,000,000 of freight money that we will keep in our own jeans.

Antagonism of Labor Pure "Bunk"

Much has already been heard about the antagonism of labor to the subsidy bill. Of all the "bunk" ever listened to which emanated from organized labor, this seems to be the limit. It is simply a question of having a job or no job for real Americans who depend on the sea for a living. It is stretching things very far to have to pick out the clause regarding the proposed naval reserve, with which to find fault. The language objected to is that officers and men who belong to the Merchant Marine Naval Reserve must "obligate themselves to serve in merchant vessels acting as naval auxiliaries in time of war or during the existence of a national emergency declared by the President."

The fear seems to be that "a national emergency" might be construed as a time of a general strike and that the naval reservists might be used as "strike-breakers." Aside from the facts that such a procedure never has been resorted to in this country, and that $3,000,000 per year, the limit fixed by the bill for naval reservists, would not go very far towards manning vessels, it would seem that this idea is the figment of perverted imagination on the part of some leaders.

Opposition Did Not Originate With Engineers

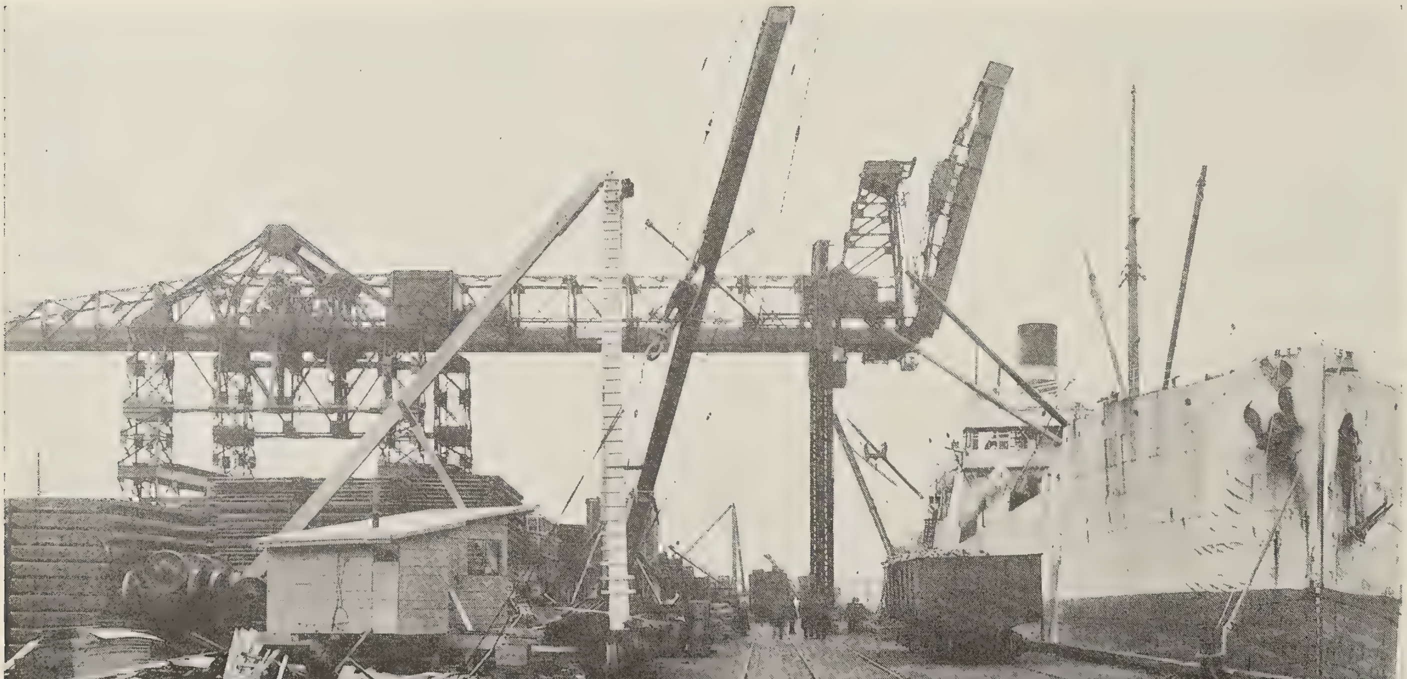
The rights of organized *American* labor on the seas should always be upheld, and, while there is not the shadow of a fact to hang such a suspicion on, as has been advanced, it is quite probable that the proponents of the subsidy bill will be perfectly willing to have the clause "or during the existence of a national emergency declared by the President," eliminated from the bill. To the credit of the engineers' associations, composed as they are entirely of American citizens, it may be stated that the opposition did not originate with them and that they realize in common with all other patriotic Americans that the subsidy bill is the one great effort which promises to give us the much desired merchant marine.

Merchant Marine Association Doing Effective Work

The National Merchant Marine Association, composed as it is of the leading shipowners, builders and operators, and many prominent exporters from all parts of the country, is accomplishing much good work in molding public sentiment in favor of the bill. The Charleston, S. C., Chamber of Commerce has gone on record in favor of the measure, as have also the New Orleans Chamber of Commerce, the Mississippi Valley Association and many other prominent business associations in the South and Middle West, largely through the efforts of the National Merchant Marine Association.

The association has sent out able public speakers, who appear before these commercial bodies and give very cogent reasons why the communities they represent are as greatly interested as are the people who live along the seacoasts. The Shipping Board itself, through the efforts of that splendidly equipped subsidy proponent, Commissioner Edward C. Plummer of Maine, has accomplished much in spreading facts before commercial organizations. Commissioner Plummer has made a lifelong study of this subject and there is no abler man in public life when it comes to discussing American shipping and its needs.

Taking it all together, my maritime brethren, there is no need of apprehension regarding ultimate victory, but do not let this deter you one iota from continuing every effort until the name Warren G. Harding is appended to the bill, thus making it the law of the land.



Gantry Traveling Crane at Seattle Pier

This crane, which covers a section of an open pier at Seattle known as Smiths' Cove Pier A, is of 225 horsepower, electrically driven and is lighted for night loading and operates over a distance of nearly 1,000 feet. It serves the depressed tracks in the center of the pier and also juts out 40 feet over the channel alongside so that cargo can be loaded direct from the car to ship and vice versa. This pier is used almost exclusively for general Oriental merchandise consisting of rice, beans, copra oil, hemp, matting, rubber, camphor and a great many other light commodities shipped from Japan, China and India. On this large pier the chief export cargo handled is steel, lumber, iron and machinery.

Shipping Bill Hearings Develop Exhaustive Testimony

1,500,000 Gross Tons of Passenger, Refrigerator and Fast Cargo Ships Needed to Make Our Merchant Fleet Efficient

JOINT hearings of the Merchant Marine Act of 1922 before the Committee on Commerce of the Senate and the Committee on the Merchant Marine and Fisheries were started in a committee room at the Capitol on Tuesday, April 4, Senator Wesley L. Jones presiding. This shipping bill has the unusual distinction of having been prepared by the Shipping Board, one of whose functions is to advise Congress on such policies as will, in its opinion, aid in the development and establishment of an American merchant marine.

Through the co-operation of the board, assisted by eleven well known marine experts, the President was provided with an elaborate array of facts and findings relating to our merchant marine upon which his recent message to Congress was prepared. In addition to this, a tentative bill was drafted which received the unanimous endorsement of the President and the entire Shipping Board. It was introduced in both houses of Congress in practically identical terms on the same day that the President delivered his message and in order to eliminate procrastination and delay, the Senate and House committees on marine affairs agreed to give it a joint hearing.

In order to expedite the hearings it was decided to allow each witness the privilege of giving his testimony in his own way without interruption, during which the members of the Congressional committees could make notes of the points on which they desired to ask questions. As the bill contains constructive policies of direct and indirect aid covering numerous phases of shipping, ship operation and shipbuilding, the Shipping Board arranged to have its case presented through men who are experts and specialists in their particular line, after which those interested in the proposed legislation and those opposed to it would be given the opportunity to express their views.

Construction Requirements for a Balanced Fleet

"With a reasonable amount of efficiency, we will require approximately 7,500,000 *gross tons of ocean-going vessels to maintain adequate mail and passenger service, to carry the greater portion of our estimated foreign commerce in dry commodities and to maintain our present status in the bulk oil movement.*

"Such a fleet would be composed of approximately 3,600,000 *tons of slow cargo ships;* 1,250,000 *tons of fast cargo ships;* 750,000 *tons of combination liners;* 400,000 *tons of passenger ships and* 1,400,000 *tons of tankers. To achieve a balanced fleet then would involve the construction of* 1,500,000 *gross tons of the higher class freight and passenger ships, in addition to the replacement of old vessels."*
—R. T. Merrill.

Mr. Lasker Gives a General Analysis

"The matter under consideration," said Mr. Lasker, "is not merely one of subsidy or no subsidy; it involves what shall become of the Government's vast war-built merchant fleet; what shall be done to end the large losses of governmental operation of ships through the Emergency Fleet Corporation; what shall be done to insure the overseas carriage of America's surplus products in times of peace; and it involves, in importance possibly beyond all these questions, whether America, through the possession of an adequate merchant marine, shall be self-sustaining, and self-sufficient on the seas in times of war."

He pointed out that times had changed from the pre-war condition of a debtor nation which could be practically assured that the countries that we owed which were maritime nations would furnish us with ships to carry the goods to liquidate our debts to that of a creditor nation holding the first economic place in the world. History proves that no nation that is not strong on the seas was ever able to hold the place that we now occupy.

"We find ourselves today," declared Mr. Lasker, "with the Government owning 1,442 steel ships, aggregating 7,000,000 gross tons, operating 421 of these ships at an estimated cost to the Treasury for the comming year of $50,000,000 and with 1,021 ships tied up; we find private operations, as well, being conducted at startling losses due not only to depressed world conditions but to the impossibility of the private owner maintaining himself in the face of continued Government competition."

He explained that the purpose of Government operation, as defined by law, was to build up trade routes in order that the Government ships might thus be sold with established good will to private owners. The very method chosen has worked to defeat its own purpose, for, in the upbuilding of those routes, the Government has operated ships; and, in the operation of ships, has driven its potential customers largely off the seas. Thus, we come to conclusions —from which there can be no escape—that, since continued Government operation means finally the possible and likely elimination of private operation of American ships, a method must be devised whereby the Government shall end its operation and, at the same time, insure carriage of American goods under the American flag through private ownership as contemplated by the Jones Act.

"Europe owes us governmentally and privately some fifteen billions of dollars," he said. "To pay in gold is impossible; there is not that much gold in the world. The only way that Europe can pay will be in goods, either raw materials or manufactured or partly manufactured wares. In turn, we must find new markets not only to absorb the surplus products, which Europe formerly took from us, but to provide for the sale of many of the products which Europe shall send to us in settlement of her debt. These products, if in raw or partly manufactured state, will be brought to completed processes by American labor; but, if permitted to flood our own market and if we do not find a foreign sale for them, they will so depress the price of wares at home as to threaten the prosperity of all our workers.

Farmers Demanding Marine Developments

"These newer markets lie across the ocean: to the south in the Western Hemisphere; to the east, in China and Siberia. It is the very need of trade in these markets that is the inspiration of the policy of the open door in the Far East."

"The farmer," declared Mr. Lasker, "has but recently seen

what it means to him in depression in price of his entire production when exports fail and the surplus of this production backs up at home. We have but lately seen how our Government's expenditure of $20,000,000 plus $12,000,000 from the Soviet Government, for grains to starving Russia, marked the beginning of an uprise in price of all our cereal products From the very time that these purchases began the price of wheat, corn and oats rose. It is not contended that these purchases alone were responsible for the uprise, but they were one of the several factors that resulted in the farmers' depression being alleviated.

"The farmers of our chief 18 agricultural States," he said, "with a total population of 40,000,000, are making a demand to which an affirmative response seems certain—that the ocean be brought nearer to them by the building of the St. Lawrence waterway, a conception that our Middle States will refuse to surrender until it becomes a reality. There can be no certainty of even a fair trial of that project after it is built unless we can have a profitable operation of American ships, because the carriage in that waterway is but seasonable, and other nations might not afford to work out a system of flexibility of tonnage for use in that waterway to our advantage. Assured flexibility for use of that project must come from us and from us alone. Therefore, when the farmer's dream of the St. Lawrence waterway comes true, as come true it will, it can have no assured life without an American merchant marine, and that merchant marine should be well established before the canal becomes a reality, that companies of sufficient strength may be alive to take advantage of its opening.

The Naval Auxiliary

"Having agreed to a naval program of 5-5-3 we can have no thought or hope of actual naval equality unless we can supply and bunker our Navy through our own merchant ships in time of war, should that unhappily come again. When President Roosevelt sent our Navy around the world, it had to be supplied and bunkered by foreign flag ships. Our naval jaunt showed the nations of the world its feet of clay. In 1914, when the world war began, be it said to the shame of America, she possessed but 15 passenger ships as to be of use for naval auxiliaries, while Great Britain possessed over 200 such ships. Today we possess 50 to Great Britain's 250. But when age and speed, which are the determining factors in the use of such ships for naval purposes, are considered, Great Britain's margin over us is further increased."

American Ships Making Poor Showing

"During December, foreign ships carried 76 percent of our overseas general cargoes," said Mr. Lasker, "and 24 percent was left to be carried in American ships. This 24 percent measured our success in competing against foreign nations for the carriage of our products to the markets of the world. Of the 24 percent, 19 percent was carried in Shipping Board vessels and 5 percent by private American owners.

"It must be the purpose and aim of America, and the Shipping Board emphasizes its belief that this aim can be accomplished, to carry at least 50 percent of our foreign trade, other than with contiguous countries and nearby countries under the American flag, privately operated. We are today carrying 87 percent of our oil trade with Mexico and 57 percent of our Caribbean trade in our own ships. But neither the needs of the trade with Mexico or the Caribbean call for that type of ship which is the very backbone of the second line of defense of our Navy, nor the type of ship which is the forerunner of world trade and world intercourse—the fast passenger and the combination passenger and cargo ship.

"There are many things necessary to successful ship operation in which the Government cannot engage. For instance, often it becomes necessary to buy and sell merchandise in order to insure cargoes. The most successful fleets under the American flag are those of the United Fruit Company, the United States Steel Corporation, the Bethlehem Steel Corporation and the Standard and other oil companies. The owners of these fleets are engaged in trading and thus insure full tonnage. No Government operation can do this. The Shipping Board at the present time is negotiating for the sale of several ships to a concern, which in turn is negotiating with the Chilean Government, whereby the American concern sells the Chilean Government 300,000 to 600,000 tons of coal a year for a term of years, during which time it takes 300,000 to 600,000 tons of nitrate in exchange. Thus those ships are assured of cargo through trading connections.

Government Aid Necessary

"Private ships under the American flag must be governmentally aided, because of the higher standards of living of American labor in the shipyard and on the ship. The men who build ships, work in America with a higher wage; the men who man our ships are paid more and sustained better than the foreigners. Who in America would have it different? Who in America would question that the prosperity of one should be the common prosperity of all and that these higher standards should prevail with all the people of our country? It is of prime importance, if we are to have an American merchant marine, that our merchant marine should consist of ships built by American workmen in American yards, because, if we are once again engaged in war, unless we control our own yards and our shipbuilding, we will be lacking in the means of instant and sure repair and renewal."

Government Aid Absolutely Essential

"With the experience I have had in this and other trades, I want to say that any man who claims that without a subsidy and without the kindly support of the Government he can build up permanently an American service of combination cargo and passenger ships, on competitive routes, and particularly on the Pacific, where they are most urgently needed for protective purposes, is either badly advised or, for reasons of his own, is making statements which are not so."—A. J. Frey, vice-president, in charge of operation, Emergency Fleet Corporation.

Statement of Mr. Daniel H. Cox

Mr. Cox, of the firm of Cox & Stevens, New York, prominent naval architects, pointed out that "it is obvious that the merchant marine of any country desirous of competing successfully with other countries in commerce on the high seas must be composed of ships which individually are equally as efficient as those ships of other nations engaged in the same trade." Particularly is this true of such a nation as the United States, he declared, "which labors under definite natural handicaps as compared with other nations already well entrenched in the carrying trade of the world.

"If to the unavoidable disadvantages, such as higher cost of construction with accompanying higher charges for interest on investment, depreciation and insurance, higher cost of wages and subsistence of officers and crew, lack of established connections in the various seaports of the world, and the nautral difficulty of securing business that for many years has been handled by other countries, be added to the handicap of ships not suited for the trade in which they are employed, the case is hopeless.

"Only by the use of the most efficient type of ships can we, even with the most liberal form of Government assistance, render the regular and reliable service demanded, at the going rate, and hope to make the venture a profitable one."

Mr. Cox stated that from a general knowledge of the shipping situation, it is his belief that the American merchant marine is seriously lacking in ships of the following characteristics:

(1) Passenger and mail ships of 15,000 gross tons and up, with speeds of 18 knots and over.
(2) Passenger and cargo ships of 10,000 to 15,000 gross tons with speeds of 14 to 16 knots.
(3) Fast cargo ships of 9,000 deadweight tons and up, with speeds of 12 knots and over.
(4) Refrigerator ships of 8,000 to 12,000 gross tons, with speeds of 14 to 15 knots.
(5) Ships propelled by Diesel engines or Diesel electric drive.

Homer L. Ferguson Testifies

Whether or not our legislators, now that there is no immediate danger of war, will be influenced by the importance of the merchant marine as a naval auxiliary, there is no doubt in the minds of thinking men that this is one of the most important reasons for developing our shipping. Mr. Ferguson said in part:

"As the number of war vessels is to be restricted, the importance of the merchant fleet as an auxiliary to the war fleet is correspondingly enhanced. Should war fleets be abolished altogether, the sea would be definitely in control of those powers having the largest and best equipped merchant fleets. Heretofore the American naval fleet had existed without a corresponding merchant fleet, which has generally been held as necessary to a strong Navy. Great Britain and the United States agree that their naval fleets should equal each other in strength; it does not, however, follow that their war strength on the sea will be equal, because that country having the best shipping inevitably would have a tremendous advantage. A merchant fleet is always a potential war fleet and forms, both in equipment and men, a naval reserve, whether called that or not. To neglect merchant shipping while limiting war shipping is deliberately to invite disaster. Many great issues have been decided by merchant shipping in the absence of suitable naval vessels. The British fleet of 197 vessels, of which only 34 were naval, destroyed the Spanish Armada, a blow from which the maritime power of Spain has never recovered.

"American shipbuilding up to the war had been built primarily on the demands of the Navy, and nearly all of the large shipyards had been developed mainly with the idea of satisfying those demands. While merchant shipbuilding has been important, the types and character of the merchant ships built in this country have not been at all in keeping with the best vessels built abroad, so that it has only been in our warship construction that we have kept pace with the shipbuilding art in regard to engineering features, size, power, speed and shipyard equipment both in men and tools.

"With large naval building definitely abandoned for at least 10 years, it stands to reason that the large, well-equipped shipyards must build large and powerful merchant ships, or the ability to produce, either for a merchant marine or a Navy, will become very much weakened and probably disappear. There is no engineering feat requiring more training and ability than the building of large, powerful vessels. If the number of large cruisers is limited or if they are abandoned altogether, armed merchant vessels will be quite as useful then as large cruisers are now in case of war."

Passenger Ships and Immigration

A great deal has been printed about the ruinous freight rates that shipowners have been compelled to accept for the carriage of cargo but very little prominence has been given to the fact that passenger fares are still practically at their maximum. Passenger ships in the transatlantic trade that are modern and efficient are making good money. It is this type of vessels that are badly needed to balance our fleet and it is this type of vessels that capital could be most easily obtained for, if the Government sees fit to grant sufficient aid to equalize the difference in first cost and operation between American and foreign ships.

Mr. Rossbottom, general manager of the United States Lines, testified that "the foreign steamship organizations that have been operating steamship lines of foreign registry between Europe and the United States have expended millions of dollars in their respective countries for the construction of new steamships, and have paid large dividends to their stockholders as a result of engaging in a passenger and freight traffic that either originated in the United States or was destined to the United States.

"They have not found it very difficult to convince the citizens of their respective countries that when traveling to and from the United States on pleasure, or on business, they should patronize the steamship flying the flag of the country of which they are natives. This applies equally to English, French, German, Italian, Japanese, Norwegian and other European nationalities. Neither has it seemed difficult for these foreign steamship lines to induce American citizens, whether traveling officially or on pleasure or on business, to patronize steamships of foreign registry even in preference to steamships of American registry, and, as Americans form the large majority of travelers in the first and second cabins, we have seen the rapid development of the merchant marines of all foreign countries through money earned in this country.

"There is, however, one part of the passenger traffic to the United States that Congress can assist in diverting to steamships of American registry, and thereby furnish the nucleus of an earning capacity that will place American steamships in a better position than ever before to compete with foreign steamship lines for the traffic to the United States, and that is by favorably considering the suggestion that has been made, that not more than 50 percent of the alien passengers arriving in the United States shall be brought here in foreign vessels."

Time Opportune for Building Up Our Merchant Marine

"This is the time to start the upbuilding of our merchant marine. The foreign lines have been hit just as well as we have, and while they have not abandoned a single essential route or service that they covered prior to 1914, *they are reducing their tonnage in keeping with reduced revenue and volume of cargo moving. If we can establish our services, therefore, under existing conditions, we will surely prosper as these conditions improve, for it will give us an opportunity of proving to merchants that we are in the business to stay, and thus will gain their good will and their support when world trade improves. This, however, cannot be done unless the Government comes to the aid of the merchant marine for reasons previously set forth."*—W. J. Love, vice-president, Emergency Fleet Corporation.

Developments in Marine Insurance

Liner Rates for Shipping Board Boats—"Leviathan's" Insurance—Floating Mines—Lake Navigation—Pilferage

By "Bordereaux"

IT has been a distinct achievement to secure such fine co-operation between marine underwriters and the Shipping Board authorities as to gain the significant concession of first class liner ratings for the best grade Board vessels. This places the latter on a parity with similar tonnage with which they have to compete in foreign carriage, and will attract a substantial volume of shipments to American vessels—thus greatly benefiting both shipper and shipowner. One authority has estimated that the saving in insurance cost to shippers will vary between five and twenty-five cents per hundred dollars carried.

In this department last month an account was given of the organization of a determined effort to work out a classification of Shipping Board vessels for insurance rating purposes, through committee conferences representative of the Board and of leading marine insurance interests. Sooner than could have been hoped for by the most sanguine have come the fine results alluded to above. They represent mutual concessions—a willingness on the underwriters' part to stretch a point wherever they could, and on that of the Board to correct the minor structural defects in their vessels objected to by the former. For an initial step in the proposed series of agreements it is a decidedly important one. The first class ratings are applicable to vessels of the Shipping Board under twenty years of age, as also the 535- and 522-foot types for both passenger and cargo service, and the former German liners now under the American flag in the Atlantic trade. They affect such lines as the Munson, United States, Admiral and Pacific Mail, operating to South American, Far Eastern and European points.

The classification conferees are now at work on Shipping Board vessels of the next grade of importance, and in order thoroughly to understand their capabilities in this respect the underwriters are studying their voyage accounts to learn of their behavior at sea, the ability of their officers and crews, their engine capacity, etc. These out of the way, the smaller freighters are to come up for consideration.

In the conferences to date the underwriters have been represented by Charles R. Page, Hendon Chubb and William H. McGee, and the Shipping Board by Vice-President William J. Love of the Emergency Fleet Corporation, Commander R. D. Gatewood and B. K. Ogden.

Insuring the Leviathan

WIDESPREAD commendation is very properly being accorded American underwriters for the admirable support they gave the Government in the insurance of the *Leviathan* on her run to the Newport News yards where she is to be reconditioned for service in the Atlantic passenger trade. The brokers whom the Government called in to handle the placing of the insurance are loud in praise of the fine spirit displayed by our underwriters in drawing the bow to its full American capacity. While it is true that our market was exhausted before half of the required coverage had been effected, and that as much more had to be placed elsewhere, the fact remains that American marine insurance did its best, and in so doing eclipsed any previous performance of the kind in this country. Incidentally, the "get together" spirit manifested demonstrated the effectiveness of the American Marine Insurance Syndicates; only one office outside of the syndicate membership participated in the insurance.

The eighty odd companies in the syndicates accepted $2,000,000 for the trip to Newport News at a rate of one-quarter percent and on a valuation of not less than $4,000,000. The other office took $200,000 additional. This left $2,000,000 to be placed abroad. On betterments at the yards, covering on labor and materials and certain incidental expense, a builder's risk insurance was taken out by the Government for a total of $6,551,000. This attached from the time the vessel reached the yards until the reconditioning has been finished—a period of between twelve and fourteen months, it is estimated. The Government assumes the risk on the vessel itself. Of this builder's risk coverage the syndicates accepted $2,500,000, and the balance was placed elsewhere. The valuation was fixed at not less than $4,000,000.

Floating Mines Still Being Found

IT may have been a considerable time since the late world war ended, but war risk insurance is still desirable. The Hydrographic Office of the Navy Department recently sent out a radio broadcast announcing that a floating mine had been sighted directly in the pathway charted for lines plying between Boston and Europe. The exact location was given as south of the Grand Banks and west of the junction at sea where vessels bound from Europe for Boston leave the track of the Europe-New York liners and bear almost due west. Since the first of last year eight floating mines have been located in the North Atlantic off the American coast, and two off our coast to the south.

Lake Navigation Opens

THERE is a general feeling of optimism among underwriters with respect to the outlook for a better season than last in insurance operations on the Great Lakes. Ice conditions were favorable in the neighborhood of the upper ports considerably earlier than the official date of the opening of navigation, which is April 15, and there was an occasional sailing around the first of the month. The former valuation of $70 per ton will probably prevail this season, and the rates will be little altered despite the complaint of the underwriters that they should be and that the margin of profit is always too near the vanishing point for comfort. It is anticipated that the strike of the coal miners will have the effect of eventually reducing the output of the mines that ship from the lower ports. This would mean that the freighters that carry full cargoes of ore from Lake Superior would have to return light, as coal is regularly their principal cargo on the voyages north.

A Significant Straw

THAT a revival of foreign trade and a consequent increase in ocean marine insurance operations is due in the near future is the significance attached to the entry into that field of the powerful group of companies composed of the North British and Mercantile, Pennsylvania Fire, Commonwealth of New York, and Mercantile of America. This

important step has more than over-balanced the regret so generally expressed on account of the recent retirement of the Ætna Insurance Company from ocean marine. It is felt that such astute underwriters as those in control of the North British group would not have made this move had they not weighed every probability in advance and concluded that the worst is over and that better times for marine insurance are scheduled for an early appearance. Excellent judgment was also exercised in the selection of a marine insurance manager, their choice falling upon the veteran Albert Ullmann, who has been one of the most highly regarded underwriters in the New York market for the past twenty years.

Foreign Manager Appointed

STILL another indication of faith in our foreign trade campaign is conveyed by the action of the American Foreign Insurance Association in selecting John Ferguson, until recently manager of the Union Marine Insurance Company of Liverpool, as marine manager. Mr. Ferguson brings to his new and important duties an experience of twenty-six years as a marine insurance expert at Liverpool, Manchester and New York. He has been in command of a group of 250 agencies throughout the world, as their supervisor, and is eminently equipped to handle the many intricate problems involved in securing to American underwriters their proper share of coverage on world trade. As rapidly as circumstances justify it he will establish general headquarters in the various countries and through them sub-agencies at numerous important local points. There is general satisfaction in the selection of so capable a manager, and underwriters are looking forward to an increased revenue from remote geographical areas in consequence of the steady expansion of the American Foreign Insurance Association.

Favor Use of Spuyten Duyvil

UNDERWRITERS on inland marine risks are urging the adoption of the proposed plan of purchasing sufficient property at Spuyten Duyvil to enable the Harlem River to be widened and deepened so as to permit modern canal barges destined from North River points to East River points to make the trip through the river instead of proceeding as at present around the Battery, a distance of some twenty-eight miles.

Organized Pilferage

REPORTS from authoritative sources continue to accumulate evidence in substantiation of the belief that pilferage on the North Atlantic has reached a stage of scientific organization. It is now next to impossible to determine whether these depredations have occurred on board ship or not, and this is a matter of the utmost moment to the shipowner. Substitution of worthless junk for the original contents of the cases has reached a degree of perfection that elicits something akin to admiration. Most of it is believed to be done on trains or on lighters, and it is being urged that more extensive use be made of the numerous effective safety devices that have recently been introduced for the greater security of packing.

Collision a Marine Risk

JUDGE HOUGH recently decided, in the United States District Court, Southern District of New York, that a collision between vessels sailing in convoy and without lights was the consequence of a marine, not a war, risk. The court refused to consider the nature of the cargo as relevant, insisting that it was the nature of the operation which was the determining question. Negligence on the part of the navigators was maintained as the proximate cause of the collision. The underwriters were held liable for the loss. Such a court decision may come in handy in event of outstanding war risk claims coming up for settlement by shipowners.

Freight Claims

IT is frequently asked whether claims may be successfully pressed on account of freight which has been unearned by reason of the loss of a vessel, or for non-delivery or short delivery of merchandise. No accurate general answer can be given, but it is suggested that when the freight unearned can be accurately computed the amount thereof be added to the bill against the carrier. It may or may not be honored. There is usually a provision inserted in the contract of affreightment whereby the freight accrues to the shipowner's vessel "lost or not lost." It might be possible, if the amount involved were sufficiently large to justify suit, to collect the amount of freight that has been paid but unearned because of failure to deliver the merchandise. In the main, however, it is too small a matter to take much bother over.

Oil in Harbor Waters

INDISPUTABLY there is much room for improvement as regards the pollution of harbor waters through the discharge of waste and fuel oil, but even so, matters are on the mend. The National Fire Protection Association recently came out with a circular calling attention to unsatisfactory conditions in this respect at certain locations, notably Beard's Erie Basin, Atlantic Basin and the mouth of the Gowanus Canal, Brooklyn. It finds a general slight improvement of late and accounts for it on account of the co-operation of the shipping industry, which the Supervisor of New York Harbor has secured by the formation of a special committee. The activity of the United States Attorney's office in connection with specific violations of the law is also believed to have helped the situation. Better facilities are gradually being afforded for the removal of oil from ships, making it more convenient to dispose of it than to throw it on the water. National legislation, intended to improve conditions not only with respect to New York and other harbors, but also in behalf of the preservation of fish and bird life, as well as the beach resorts, is before Congress.

Inferior Ships

CHEAP freight rates are attracting shipments from South America to the United States in steamers of decidedly inferior class, not to mention lighters in tow, and sailing ships. This is giving the underwriters considerable concern. They cannot understand why merchants should be willing to take such serious chances with their cargoes, particularly as there is no occasion for so doing in view of the repletion of idle but standard steamers. A large amount of sail tonnage is now being operated in the North Atlantic and West Indies trade, and wool cargoes are going under sail from London to so remote a point as Australia. It should be borne in mind that many underwriters do not insure sailing ships at all, and merchants employing that form of transportation are likely to find themselves embarrassed when it comes to effecting coverage under open or closed policies. It is much better all around to make use of safe bottoms.

No German Insurers Coming

ABOUT so often a rumor gets whispered around to the effect that German underwriters are planning to resume operations in the United States. There is nothing to it. Financially it would be impossible for German unadmitted marine writing companies to establish them-

selves here; the low rating of the mark on exchange would effectually dispose of any such undertaking. The Germans themselves are without information as to a probable date of release of funds of German companies that were operating in New York prior to the war and whose American resources now rest with the alien property custodian. Congress will have to settle that. Liquidation of claims against German companies on policies in force before our Government seized the branch offices has been completed, but the remaining assets have not been released and nobody knows when they will be.

Some London Recommendations

IN the interesting report of the Committee of the Council of the British Chamber of Shipping, recently published, an almost despairing review is made of the wholesale amount of pilferage still being carried on in all parts of the world. The committee conducted a world-wide investigation of the subject in order to try and arrive at adequate remedial measures. It found a general paucity of police protection and severely arraigned the carriers for alleged laxness in safeguarding shipments while on docks and during actual loading through failing to provide adequate watchmen service and by failing to insist upon the arrest of dockhands suspected of stealing. Among the recommendations made by the committee were the following: Tallies should be taken both in and out of ship, and extended use should be made of the alphabetical system by those tallying on behalf of the ship, as it prevents collusion with those using continuous sheets tallying against the ship; there should be only one entrance to cargo holds (down the hatchway); all ventilators should be protected to prevent access to holds through them; shipowners should prosecute every detected case of pilferage; magistrates should be urged to impose imprisonment on persons convicted, as fines are inadequate; customs officials should mark with an official stamp or seal all cases or casks from which samples have been extracted; and shipowners should revise their standing instructions to masters and officers in reference to the care and handling of cargo, to bring them up to date.

Maritime Nations Propose International Regulation of Deck Loads

THE proposal of foreign maritime powers for the limitation or total prohibition of deck cargoes, and the establishment of an international load line, is of the greatest importance to American shipping.

According to dispatches received from Geneva, Switzerland, by Ernest Greenwood, American correspondent of the International Labor Office, representatives of foreign governments, shipowners and seamen on the Joint Maritime Commission of the International Labor Organization, are in unanimous agreement as to the need of international action in the matter. Whether this action will take the form of regulations based on the present British rules, as is desired by the seamen, or whether modified regulations will be adopted, as the shipowners prefer, remains to be settled. It is said that a radical divergence of opinion also exists among the delegates as to whether regulations should authorize specific rules restricting the height and weight of deck cargoes, or whether they should permit the certification of vessels as fit for the carriage of deck cargoes, according to type, and with or without a special load line.

It is contended by the seamen's organizations that many lives have been lost and many men injured at sea each year by the carriage of deck cargoes. It is the hope of the seamen to have the British regulations used as a basis in the adoption of international regulations. On the other hand the opinion seems to prevail among shipowners and shippers that the British regulations are too stringent and that elasticity might usefully be introduced into the rules. The shippers point out certain anomalies arising out of the strict application of the British rules, and mention two specific cases, one the case of a turret-deck ship; the second case was that of a ship being penalized at Hamburg for being insufficiently loaded, owing to her having rejected a deck cargo in America, because of the penalties she would incur in Great Britain for overloading.

This is the first time the question has been discussed by both shipowners and seamen. It has long been a matter for discussion among shipowners, conferences having been held at Paris in May, 1921; at Madrid in October, 1913, and at the Hague in August, 1921. The seamen themselves have gone into the matter at meetings at Washington and Antwerp.

The present joint conference is made possible by the establishment of the Joint Maritime Commission by the International Labor Organization, an autonomous association of 54 nations established under the Peace Treaty of Versailles. The present negotiations involve Belgium, Japan, Great Britain, Sweden, Canada, France, Italy, Norway and Germany, these countries being represented on this commission.

Steam Versus Diesel Drive

By J. E. P. Grant*

FOR long voyages there is no doubt but what the Diesel engine has arrived and will do more than any other single factor to reduce the cost of operation.

The selection between steam and Diesel drive depends almost entirely on the respective initial costs of these installations. Diesel engine prices in the United States are very high yet, and this, of course, decreases the range of desirability of this type of engine.

Where to draw the line between steam and Diesel drive requires special study of the particular trade in view, but generally speaking, I would say that for powers up to 4,500 indicated horsepower and for voyages of four thousand miles and over, the Diesel engine is preferable, and that for powers above that mentioned and below the four thousand miles, steam should be selected. The minimum distance of voyage mentioned above will decrease as the costs of Diesel engines come down.

New Southern Pacific Oakland Piers

By Charles W. Geiger

THE Southern Pacific Railroad has recently completed at the Oakland, Cal., mole three new piers with berthing capacity for twenty-four vessels. More of these piers can be constructed as needed. The new piers are located on the south side of the mole. The present facilities consist of three units, or piers, which are located at an angle with the bulkhead line and are respectively 100 feet, 70 feet and 75 feet wide and each 875 feet long. On pier No. 1 is located a warehouse 80 by 380 feet in size with a floor space of 30,000 square feet. The trestles are full-span so that there are no posts to interfere with the handling of loads in the warehouse. This shed is served by two tracks down the center so that cargoes may be wheeled directly from slings to cars. The entire side is made of sliding doors so that any portion can be reached conveniently. Night loading is facilitated by excellent lighting arrangement.

Fifty vessels a month, carrying lumber, are unloaded at these piers. Trucks are so arranged on the lumber piers that transfer may be made direct from boat to cars. The facility with which lumber may be handled here is illustrated by the fact that one boat unloaded 155,000 feet of lumber in two hours.

*Chief engineer, Merchant Shipbuilding Corporation, Chester, Pa.

Shipping and Shipbuilding in Great Britain

Cargo Boat Owners in Financial Difficulties—Liner Companies Appeal for More Capital—Shipbuilding Situation Chaotic

By W. H. Wendon

THE effects of the great depression in the shipping trade of the world are becoming increasingly evident in the financial affairs of British shipowning companies, notably in South Wales, where "mushroom" owners were to the fore in promoting companies during the late boom. The balance-sheets of some of these cargo boat companies covering the past year's working are now available, and it is the exception to the rule for a satisfactory result to be shown.

Failure of Cargo Boat Companies

The latest concern to announce its inability to continue trading is the Turner Steam Navigation Company, Ltd., which was formed early in 1920, with a nominal capital of £100,000, of which about £40,000 has been subscribed. The directors contribute the failure of the company to "the serious depression in shipping values, which set in a few months after this company was formed," and add that it has been found impossible to meet the heavy obligations of the company and carry on the business profitably. No less than £30,000 is due to mortgagees on the company's solitary steamer *Torquay*, of 1,054 tons deadweight, built in 1914. The mortgagees have served formal notice calling in the money forthwith. The vessel cost the company the appreciable sum of £74,000 in March, 1920, when the company was originally formed by its then promoters, but her market value at the present time is estimated to be between £15,000 and £16,000. There appears, therefore, no other course to adopt but to voluntarily wind up the company, and the necessary resolutions to effect this policy will be submitted to the shareholders.

The Bristol Channel Steamers, Ltd., is another Cardiff cargo boat concern which finds itself in difficulties. The depreciation in shipping values has impelled the directors of this company to counsel the reduction of the capital by fifty percent, representing approximately the present day value of the assets. This company provides one of the instances where, a large portion of the purchase price of the vessels not being borrowed on mortgage, the company can continue running, at all events for the time being.

The Heath Shipping Company, owning the small steamer *Deloraine*, sustained a loss of £668 on its past year's working. Added to the debit balance of £248 brought into the account, there is a total loss in the past two years of £916. The share capital issued amounts to £13,674, and there is an overdraft at the bank of £10,026. The company's steamer and leasehold buildings cost £22,250. Comment is needless.

Largest Cargo Boat Owners Fail to Declare Dividends

The St. Just Steamship Company, probably the largest purely cargo boat company in this country now that the ill-fated Western Counties Company is no more, is also experiencing troublous times, although not to the same extent as others. Partially owing to the slump, and to some extent to the fact that the company's taxation indebtedness has not yet been fully defined, the directors are refraining from recommending the customary dividend. The magnitude of the activities of this company, which is an amalgamation of single ship companies, will be gaged from the fact that it owns 21 steamers aggregating more than 180,000 tons carrying capacity, and standing in the company's books, together with investments, at two and three quarter millions sterling. It has, indeed, more money invested in shipping than any other cargo boat company in the kingdom. For the fifteen months ending June 30 last a dividend of 6¼ percent, free of tax, was paid, as against 7½ percent in 1919-20, 17½ percent in 1918-19, 10 percent in 1917-18, 20 percent in 1916-17 and 21 percent in 1915-16. It has a capital exceeding £2,000,000.

Turning from cargo boats to liners, the position regarding companies owning this type of vessel is rather more obscure. On the surface the companies are not doing badly; but appearances are sometimes deceptive. There is no disguising the fact that at all events some of the companies are in an unfortunate position following on the slump in values, for many of them have disbursed gigantic sums in acquiring boats at top prices to replace vessels lost during the war.

Liner Owners Ask for More Capital

Appeals for further capital continue to be a feature in the liner trade. Since the beginning of 1921 these appeals have aggregated no less than £14,500,000, and there are more to come. The Cunard Company initiated the movement in January last year, when it applied for, and obtained with consummate ease, £4,000,000. Then followed the African Steamship Company, the Clan Line of Steamers and the Union-Castle Line, and finally we have the P. and O. Company securing a further £3,500,000 and Messrs. Lamport and Holt £2,000,000.

In the case of the P. and O. issue, the money, according to the prospectus, is to be applied "more especially to the construction of new vessels when prices come down to an economic figure to replace those destroyed by enemy action during the war, and to build others to meet the growing requirements of the company's business." But it is significant that, in the case of the other companies, the money will be expended in meeting the payments on steamers already built at top prices, or which have been contracted for on a similarly ruinous basis.

Prospects for the Future in Shipping

Opinions differ as to the stability of the industry and the prospects for the future, but at least one shipowner, Sir William Noble, Bart., whose authority to speak on matters maritime cannot be questioned, is not disposed to indulge in pessimism. He goes so far as to say that the shipping industry is now approaching convalescence, if, indeed, it is not wholly on the road to recovery. He prescribes a sane and reasonable optimism as one of the best aids to this recovery, and expresses the view that a cynical pessimism can only prolong the period of distress. He points to the fact that in other countries the condition of the industry has been just as bad, if not worse, and deprecates the use of what he terms "quack remedies." He pleads guilty to being an incorrigible optimist and declares his admiration for the pessimist who has the courage, when the soup kitchens are open, to order half-a-dozen steamers. For his own part he prefers the philosophy of the typical Irishman, who, when difficulties confronted him, said: "Let me look back into the future."

According to the latest statistics, there are more than 2,000,000 tons of British and foreign shipping at present laid up in the 36 principal ports of the United Kingdom, a figure which compares with one and a half million tons in January last year. Of the two million tons referred to,

no less than 1,900,000 tons fly the British flag. The subjoined table gives particulars of unemployed seagoing ships laid up in these 36 United Kingdom ports since the beginning of 1921:

		British		Foreign	Totals
1921	No.	Gross tons	No.	Gross tons	Gross tons
January ...	...	....	...	....	1,505,000
April	...	....	...	....	2,732,000
July 25.....	883	2,641,000	140	323,000	2,964,000
October 25.	654	1,853,000	88	221,000	2,074,000
1922					
January 1..	621	1,887,000	91	205,000	2,092,000

Taking the smaller ports into consideration, it is calculated that at present there are vessels representing two and a quarter million tons laid up in the ports of the United Kingdom. With regard to British tonnage only, no account has been taken in these figures of ships lying in foreign ports. Careful computation places the total figures of unemployed British ships at 2,250,000 tons, out of a gross tonnage of over 18,000,000 tons, or 12½ percent. High as this proportion is, the figure does not compare unfavorably with foreign countries.

Regulations for Carriage of Wood Deck Cargoes

The important question of the regulations regarding the carriage of wood deck cargoes, which have been the subject of considerable discussion during the last ten years by various sections of the interests concerned, has reached a still more interesting stage. The Chamber of Shipping of the United Kingdom has addressed a communication to the Board of Trade, setting forth the views of the International Deck Cargoes Committee, which was one of the committees appointed by the International Shipping Conference held in London last November. In submitting the proposed regulations for the consideration of the Board of Trade, the Chamber of Shipping draws attention to the different practices of various countries in the definition of "winter seasons in Northern Europe and in the Northern Atlantic," which, as is pointed out, for the ordinary cargo freeboard regulations, are different from the present British regulations regarding the carriage of wood deck cargoes. The Chamber considers that the Governments of various countries should take common action to define the winter season, not only for the North Atlantic, but also for other regions of the globe, so that as far as possible fair treatment may be given for the seasonal variations of freeboard which all systems of rules take into account. The Chamber observes that this is the first time that it has been possible to secure unanimous agreement as to such technical regulations among all the countries in Northern Europe primarily concerned in the carriage of deck cargoes, and that the acceptance of rules of this nature will not only facilitate the free intercourse of merchant ships of all nationalities, but will appreciably reduce the cost of transportation of light wood timber to the British Isles—an important point in the general economy of the country.

The committee recommends that:

(1) All ships should have a certificate of fitness where the deck cargo exceeds 5 percent of the ordinary deadweight capacity;

(2) The various maritime States should agree on a uniform system of issuing such certificates;

(3) International expert opinion should be asked to decide whether, in addition to the above requirement, a uniform system of fixing a special load line and regulations restricting height and weight of deck cargoes would be desirable.

Shipbuilding Hard Hit by Taxation and Wages

The situation in the shipbuilding and engineering industries is by no means an encouraging one. Labor disputes on wages and the exercise of managerial functions have brought the trades to something amounting to chaos. Added to this, such few orders as are being given out are finding their way abroad, whereas in the normal sequence of events they would undoubtedly be booked up by firms in this country. A Hartlepool firm which tendered for five passenger ships for a Mexican navigation company is advised by the shipping company that England is not at present in a position to compete in shipbuilding with France, Italy or Germany. The lowest British tender was £99,000 per ship, whereas the price quoted abroad, apart from German builders, was as low as £47,000. Sir Alexander Kennedy, managing director of the Fairfield Shipbuilding and Engineering Company, Ltd., of Glasgow, holds the view that the breath of the shipbuilding trade is being crushed out by taxation and wages. In England and Scotland fifty percent of the shipbuilding berths are empty, and fifteen percent are occupied by vessels either canceled or on which work has been suspended. Moreover, despite the fact that shipbuilders are willing to sacrifice all profit, no new orders are forthcoming. In one English district with thirty-five berths, only two vessels are building, and twelve thousand men are idle.

Channel Steamer Anglia

One of Four 25-Knot Luxuriously Fitted Vessels Built by Messrs. Wm. Denny & Brothers, Dumbarton, for the Holyhead-Dublin Service of the London & North-Western Railway Company. The Vessel is 395 Feet Long Overall, 45 Feet molded Beam and is Certified to Carry 1,522 Passengers. Propulsion is by Twin Screw Geared Parsons Turbines Supplied with Steam From Nine Babcock & Wilcox Watertube Boilers.

Triple Screw Liner Reliance, Sister Ship of the Resolute, Latest Additions to United American Lines' Fleet for New York-Hamburg Service

Passenger Liners Resolute and Reliance

Two 20,000-Ton Steamers Commissioned by the United American Lines for Their New York-Hamburg Service

WITH the arrival in New York on April 23 of the 20,000-ton oil burning, triple screw, passenger steamer *Resolute* a new fortnightly service between New York and Hamburg, with calls at English and French channel ports, was inaugurated by the United American Lines, the operating company of the American Ship and Commerce Corporation. This service will be maintained by the *Resolute* and a sister ship, the *Reliance*. On the eastward voyage the vessels will call at Plymouth and Boulogne and on the westward voyage at Southampton and Cherbourg. The time of passage to England and France will be about 8 days and to Hamburg about 9 days.

The entry into the North Atlantic service of these two luxuriously appointed passenger liners marks an important event in the history of the American merchant marine, as the *Resolute* and *Reliance* are the largest *privately owned* passenger vessels flying the American flag. These ships were originally designed for the South American service of the Hamburg-American Line. Both were laid down in Germany in 1914, the *Resolute* at the yards of the Actien Gesellshaft Weser at Bremen and the *Reliance* at the yards of John Tecklenborg, Bremerhaven-Geestemunde, but neither was finished until after the war in 1920 when they were sold to the Royal Holland Lloyd Line. In this service they ran for a year from Amsterdam to Buenos Aires via Boulogne, Plymouth, Vigo, Lisbon, Las Palmas, Rio, Santos and Montevideo, a voyage of 6,642 miles each way.

With the transfer of these vessels to American registry W. A. Harriman, chairman of the United American Lines, selected for them the names of two of the famous American yachts which successfully defended the *America's* cup against foreign challengers. By so doing he sought to commemorate in two of the finest ships flying the American flag in the competition of commerce the achievements of two contenders which so valiantly carried the American flag in the competition of sport.

Principal Dimensions of the Resolute

Although built in different yards in Germany, the two vessels are practically duplicates. The main particulars of the *Resolute* are as follows:

Length overall	618 feet
Length between perpendiculars	588 feet
Beam	72 feet
Depth to shelter deck	43 feet 9 inches
Draft, loaded	28 feet ¼ inch
Displacement, light	16,000 tons
Displacement, loaded	23,080 tons
Deadweight tonnage	7,080 tons
Weight of fuel oil	3,300 tons
Weight of fresh water	1,500 tons
Tons per inch of immersion	78
Horsepower	15,000
Speed	16¾ knots
Number first class passengers	364
Number second class passengers	276
Number third class passengers	467
Total number of passengers	1,107

Classed at the highest rating of Germanischer Lloyds the *Resolute* and *Reliance* are of the most modern type of construction and arrangement and no expense has been spared to make the vessels conform in appointments and equipment to the highest standards in passenger travel. The hull is subdivided by a double bottom extending from the forward

S. S. Resolute—Ladies' Saloon

S. S. Resolute—Smoking Room

S. S. Reliance—Winter Garden

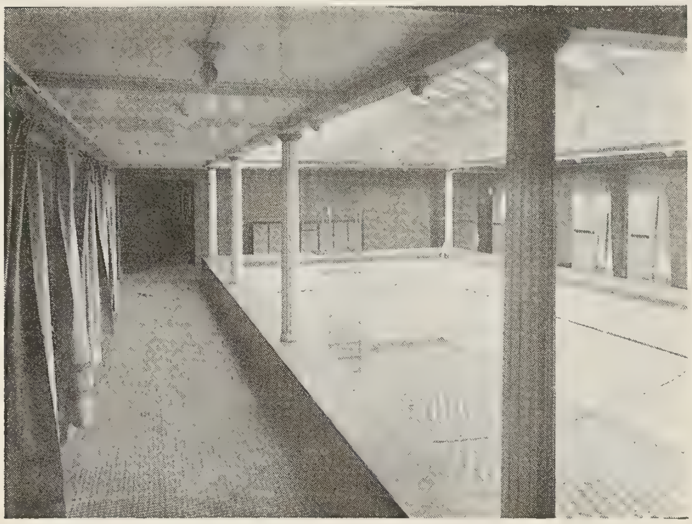
S. S. Reliance—Library and Writing Room

to the after collision bulkheads and by ten transverse watertight bulkheads carried up to the shelter deck. Above the hold and orlop decks there are in all seven decks, designated from the top, as A (Boat), B (Promenade), C (Bridge), D, E, F and G decks. All first class accommodations are amidships on A to E decks, inclusive, the second class accommodations aft on C to F decks, inclusive, and the third class accommodations forward on D to G decks, inclusive.

Propelling Machinery

Propulsion is by triple screws, the wing screws being driven at 80 revolutions per minute by four-cylinder triple expansion reciprocating engines with cylinders 29.5 inches, 49.2 inches and (two) 53.1 inches diameter by 59.05 inches stroke and the center screw at 210 revolutions per minute by a Parsons low pressure turbine taking steam from the low pressure cylinders of the reciprocating engines at 15 pounds per square inch. Seventy-one men are required for the engine room crew.

Steam is supplied to the high pressure engines on the wing screws at 240 pounds per square inch pressure by fourteen oil-fired Yarrow watertube boilers operating under Howden's system of forced draft, without superheat. The forced draft fans are operated by reciprocating engines. Each boiler has



S. S. Resolute—Swimming Pool

3,200 square feet of heating surface and 61.2 square feet of grate area and is equipped with three Vulcan burners.

The boilers are located in two boiler rooms separated by a fuel bunker having a capacity of 710 tons of oil. The total amount of fuel oil carried is 3,300 tons and the average consumption 165 tons per day. The uptakes from the boilers in the forward boiler room lead to the forward smokestack and those from the after boiler room to the center stack. The after stack, which is over the engine room is used for ventilation, exhaust from the galleys, etc.

The auxiliaries, all of which were supplied by the Vulcan Works, at Stettin, Germany, include four 115-kilowatt turbo generators, four 30-ton evaporators and two refrigerating machines.

First Class Accommodations

Accommodations for the 364 first class passengers are provided amidships extending over five decks.

On the boat deck, besides the fine open promenade space afforded, there are offered special inducements for recreation and sports in the form of an elaborately equipped swimming pool and gymnasium. The swimming pool itself measures 30 by 12½ feet and is surrounded by dressing rooms, shower baths, electric light baths and other equipment essential to its use. Aft of this is the gymnasium, fully equipped under the Zander system, alongside of which is a botanical garden and a photographers' dark room. Amidships on the boat deck is the wireless telegraph room and forward are the officers' quarters.

Except for a few special staterooms the entire promenade deck is given over to the first class public rooms and promenade. As shown by the illustrations these rooms provide all the comfort and luxury found in the best hotels on shore. In decoration, appointment and equipment they are designed to satisfy the most discriminating traveling public. The promenade space itself is 20 feet wide and extends clear around the ship with a length of 320 feet on each side. The forward part is protected against stormy weather by sliding windows.

Occupying a large space forward on the promenade deck is the winter garden. Arched by a dome of colored glass and sumptuously furnished this is used as the assembly room for dances, concerts and other entertainments. Further aft on this deck is the ladies' saloon, lighted from above by a glass dome and from the sides by broad groups of windows. Opening from the ladies' saloon on the starboard side is a spacious library and writing room which, with its arched and beautifully decorated ceiling, has an atmosphere of unusual distinction. The walls are paneled and along the inboard side are large bookcases containing the ship's library while opposite in front of the windows are writing tables.

At the after end of the promenade deck is the smoking room, paneled in mahogany, and just outside this the terrace cafe or promenade deck lounge.

The bridge deck amidships is given over entirely to first class staterooms except for the main lobby in the center containing the main office, purser's and chief steward's offices and the barber shop and ladies hairdressing parlor.

On D deck amidships is the main dining room extending the full width of the ship and in the center rising through two decks to a height of 16 feet. At the forward end of the room at the level of the bridge deck is a balcony for the orchestra. The color scheme for the dining room is pearl grey and lighting is accomplished by concealed incandescent lamps. The galley and pantry are below on E deck.

Aft of the entrance to the main dining room on the starboard side is a children's room decorated with paintings of characters familiar to readers of fairy tales and furnished with specially constructed low tables and chairs. The remainder of D deck amidships is given over to first class staterooms as is also a similar section of E deck.

The staterooms are large and well ventilated. In the first cabin bedsteads take the place of berths. Many rooms contain dressing tables, desks and chairs, in addition to the usual wardrobes and sofas. A large number of rooms are arranged for one passenger. Each room is supplied with running hot and cold water.

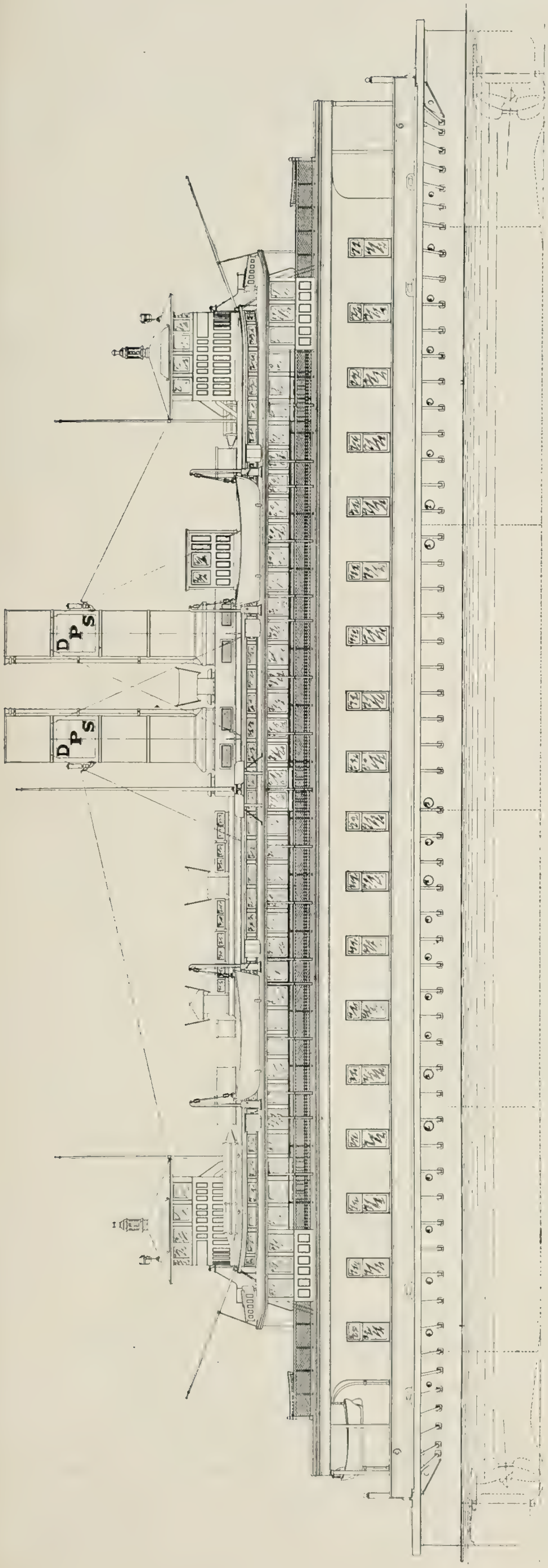
The private suites are provided with sitting rooms, baths and trunk rooms. When so desired meals are served in the suites.

Second and Third Class Accommodations

For second class passengers, whose quarters are aft, promenade space is provided on the promenade and bridge decks. The second class public rooms are on the bridge deck and include a large, pleasingly appointed dining room, a handsomely furnished social hall or lounge, a smoking room and ladies' parlor.

The staterooms differ from those in the first class accommodations mainly in that they have berths instead of bedsteads, but the fittings are up to date in every particular. Many of the rooms accommodate two passengers only.

The third class quarters, located forward, have been transformed from open berths to rooms for two and four passengers. Dining rooms, a ladies' parlor and a smoking room are provided and promenade space is available on C deck.



Outboard Profile of New Turbo-Electric Ferryboats Designed for Staten Island Service in New York Harbor

New Turbo-Electric Ferryboats for New York City

Three Turbo-Electric-Drive Vessels to Be Added to Staten Island Service in Connection with New Pier Developments

THE new pier developments on Staten Island which included the addition of twelve municipal piers to the six privately owned piers in that locality immediately brought up the question of proper facilities for handling freight to and from the seagoing vessels which will berth at these piers, and in order to meet the needs for increased ferry service the Department of Plant and Structures of New York City has prepared designs for three new turbo-electric-drive ferryboats which, when built, will take care of the needs of this new commercial enterprise.

These new ferryboats will operate between the foot of Cortlandt Street, Manhattan, and St. George, Staten Island. In view of the fact that the vessels are designed primarily to handle the trucking business to and from the piers, the lower deck will be devoted entirely to this end and will be arranged to provide four driveways. In addition to this, however, accommodations for passengers will also be provided, but the arrangements for passengers will be confined to the upper deck.

Bids for the construction of these vessels were submitted to the Commissioner of Plant and Structures on April 20 by the Staten Island Shipbuilding Company and the Tebo Yacht and Basin Company.

The Staten Island Shipbuilding Company bid $1,103,900 for two boats complete and $1,639,900 for three boats. The bid of the Tebo Yacht and Basin Company was for $1,160,000 for two boats and $1,730,000 for three boats.

Hull

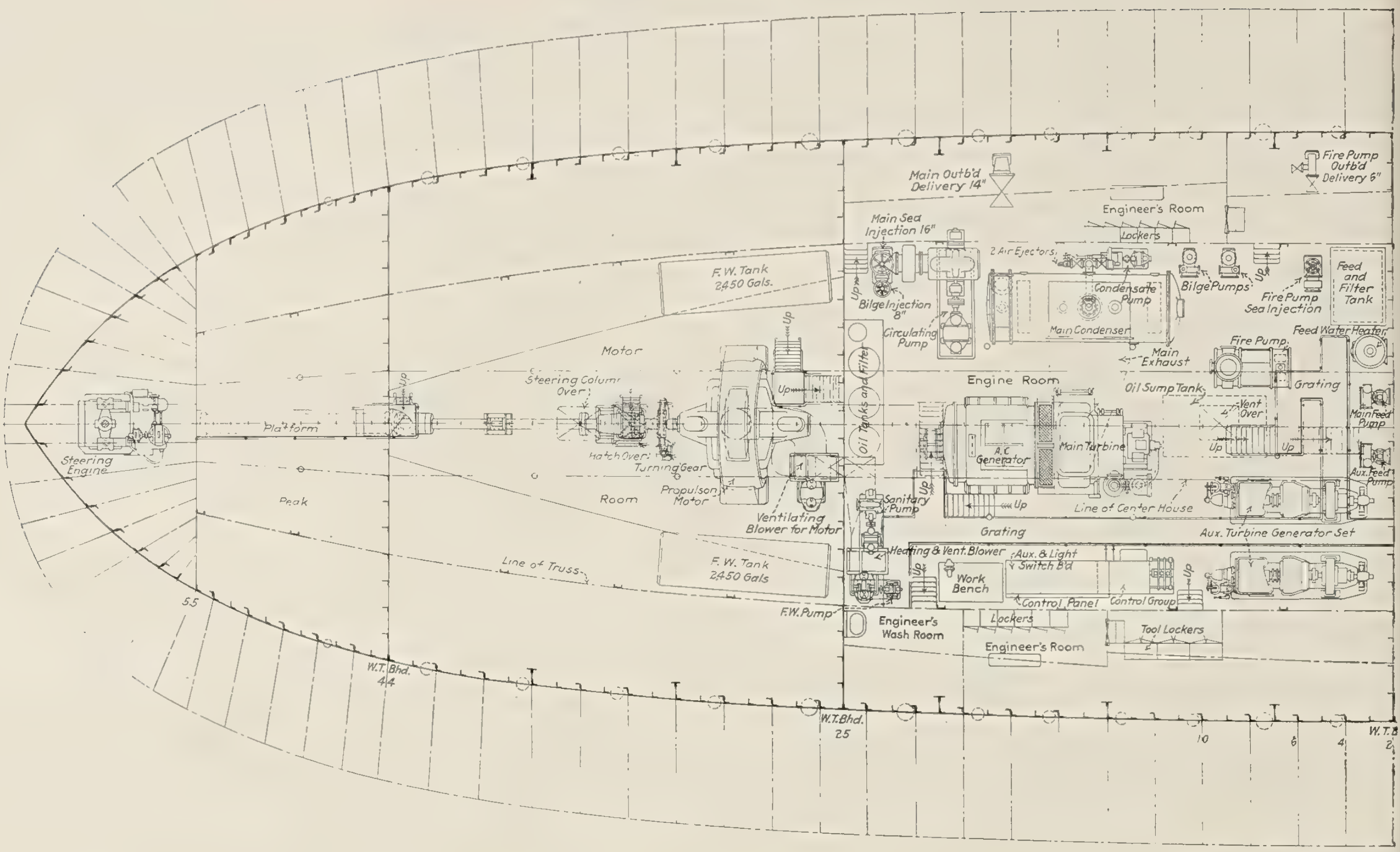
The preliminary designs of the vessels have been prepared in such a manner that either transverse or longitudinal framing may be adopted, and this point was made a subject of alternative bids from the builders. The above bids in each case were based on transverse framing and the Staten Island Shipbuilding Company stipulated a reduction therefrom of $2,100 per boat, if longitudinal framing is adopted. A deduction on the same basis of $6,000 per boat, was stipulated by the Tebo Yacht and Basin Company.

Each vessel will be subdivided by 5 transverse bulkheads extending to the main deck and arranged as shown.

The longitudinal strength of the vessels will be maintained by a longitudinal truss arranged on each side of the centerline. On account of their size and the special conditions under which these vessels will operate it is doubtful whether ferryboats of a similar nature would be suitable for any city other than New York. The machinery arrangement, however, is particularly interesting as representing the trend of modern practice for ferryboat propulsion.

Main Propelling Machinery

The main propelling machinery consists of two main electric motors, one located at each end of the vessel, both of which are operated by a single turbo generator. The main turbine will be of the impulse, marine condensing, rigid frame, three-bearing type, direct connected to the main generator. This unit will have a capacity of 2,200 horsepower at the propeller shafts. The water rate of the turbine will be approximately 10.5 pounds per propeller shaft horsepower each with 250 pounds steam pressure, 200 degrees F. superheat at the throttle, and 28.5 inches of vacuum when delivering 2,100 horsepower at the stern propeller shaft and 100 horsepower at the bow propeller shaft, excluding the power required for excitation.



Hold Plan, Showing

The speed of the turbine will be approximately 3,000 revolutions per minute when delivering the full 2,200 shaft horsepower and it will be constructed to allow a speed variation from 30 percent of normal to the maximum required. Under the normal operating conditions the total horsepower will be 1,900 or about 1,800 at the stern propeller and 100 at the bow propeller.

As is customary in installations of this type, a governor will be provided which shall limit the turbine speed to 7 percent above normal and an emergency governor of the eccentric ring type will be provided which will operate should the speed above normal reach 11 percent.

Main Generator

The main generator will be of the three phase, alternating current type, direct connected to the main turbine. It will have a capacity of 2,300-3,000 volts and a maximum operating speed of not less than 3,000 revolutions per minute. The excitation required at full load when delivering 2,200 horsepower at the propeller shafts will be approximately 20 kilowatts.

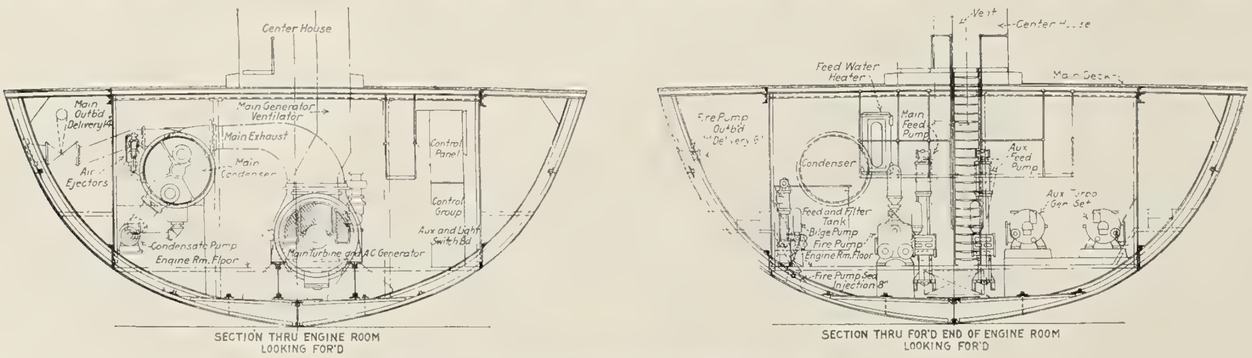
The stator frame will be made of cast iron in one piece and the punching ribs cast integral with the frame. The armature core will be built up of annealed and enameled segments of thin sheet iron designed and constructed so as to obtain a minimum core loss. Punchings will be secured to the stator frame by means of dovetailed keys and heavy cast iron flanges at each end will hold the core securely under high compression. Armature punchings will have open slots to permit the use of form wound coil with proper insulation. The winding will be made up of rectangular wire thoroughly impregnated with a high grade moisture resisting compound.

The rotor will be made of a one piece heat treated solid steel forging. This forging will form both the shaft and core of the rotor and the field portion of the magnetic circuit. The rotor winding will be made of suitable copper strips wound edgewise and insulated with mica tape.

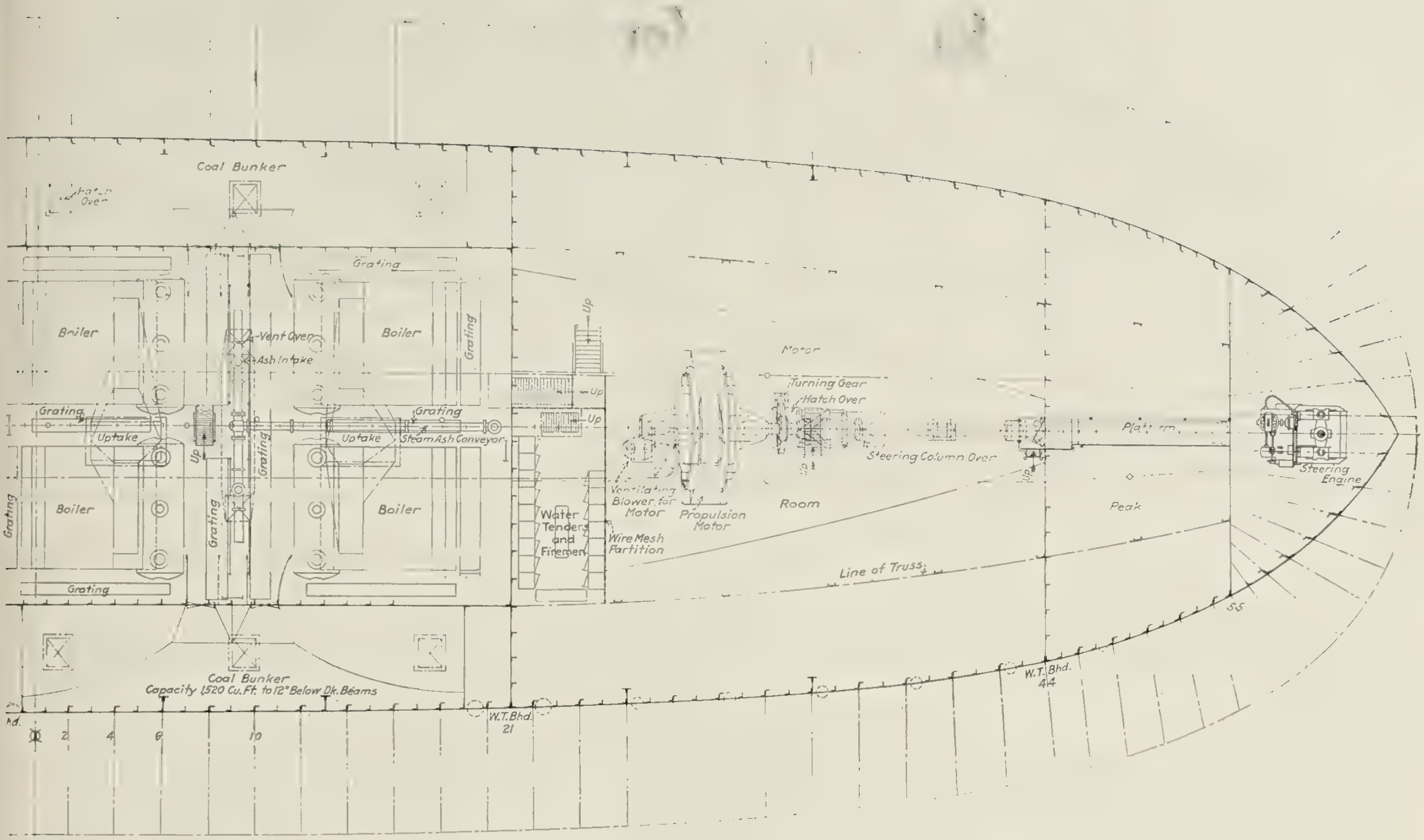
The generator will be ventilated by centrifugal fans integral with the rotor.

Main Propulsion Motors

The two main propulsion motors will be of the three-phase, alternating-current, induction type of 2,300-3,000 volts capacity. Each motor will be provided with a stator winding for operating the stern propeller at full speed and power



Transverse Sections Through Engine Room



Machinery Arrangement

(2,100 horsepower and about 176 revolutions per minute) and a stator winding for operating the bow propeller at reduced speed and low power (about 100 horsepower and 132 revolutions per minute). This speed change will probably be secured by pole changing. The outside diameter of the motors will be approximately 10 feet.

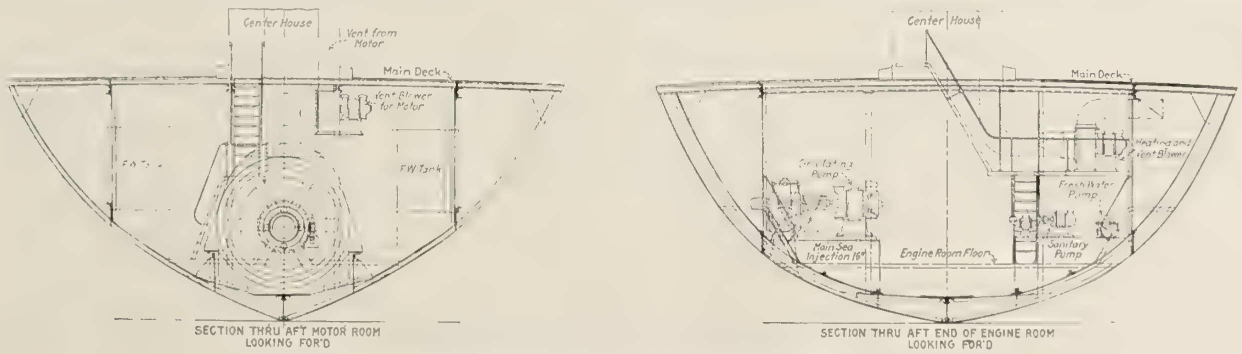
The stator frame will be made of cast iron and designed to resist deflection from strains due to weight of punchings and windings or to any magnetic pull. Frame and bearing brackets will be made watertight below the shaft center, and will be provided with means for draining any condensation that may occur.

The stator core will be built up of thin steel punchings secured to the frame by means of dovetailed keys attached to the ribs in the stator frame. Ventilation of the core and windings will be secured through radial ducts provided at suitable intervals along the length of the core and opposite similar ducts in the rotor. The stator coils will be made up of a suitable number of turns of rectangular wire with cotton and mica compound covering. The coils will be held in place in the slots by means of thin wedges of insulting material. The external ends of all coils will be laced to an insulated steel ring in such a manner as effectively to prevent vibration and this steel ring will be securely fastened to the stator frame.

The rotor spider will be made of cast steel keyed and pressed on the rotor shaft and the rotor shaft will be made of steel of sufficient size to insure rigidity under all conditions of service. The rotor core will be built up of segmental laminations made from thin steel which will be held by slots in dovetailed ribs of the rotor spider. Radial ducts and spacer fasteners will be provided similar to those for the stator. The windings will consist of two squirrel cage windings. The high resistance winding will be brazed with silver solder to the end rings and the low resistance winding will be welded to the end rings.

Bearings will be of the ball seated self-alining type split through the horizontal diameter.

The motors will be designed to operate continuously at full load and full speed on the full speed winding and at full load and full speed on the slow speed winding with a temperature rise by thermometer not exceeding 50 degrees C. based on an ambient temperature of 40 degrees C. when 13,000 cubic feet of air per minute are taken through each motor by a separately motor driven blower. When operating, the combined power factor of the stern motor and the bow



Sections Through Motor and Engine Rooms

New Turbo-Electric Ferryboats for New York City

General Information

Service: Passenger and vehicle ferry between St. George, Staten Island and Manhattan, N. Y.
Owner: Department of Plants and Structures, New York City.

Characteristics

Length, over guards ... 218′ 0″
Length, between end posts ... 215′ 0″
Breadth, molded, at deck ... 45′ 0″
Breadth, over guards ... 64′ 0″
Depth, molded, amidship ... 18′ 0½″
Draft, loaded ...
Draft, light ... 11′ 0″
Block coefficient ...
Midship section, coefficient ...
Longitudinal coefficient ...
Speed, loaded, knots ...
Cruising radius, nautical miles ...
Framing ...
Class ... American Bureau Shipping for river and harbor service.

Estimated Tonnages

(In tons of 2,240 pounds)

*Weight of Hull ... 873.5
**Weight Propelling Machinery ... 332.9
Deadweight Capacity ...
Displacement, light ... 1206.4

(In tons of 100 cubic feet)

Gross register ...
Net register ...

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment and Outfit.
**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Rudder

Area ...
Dia. Stock, inches ... 9
C. Press. abaft C. L. pintles ...

Deck Machinery

Steering Gear, electric drum or electro-hydraulic type ...
Windlass ...
Capstans ...
Winches ...
...

Life Saving Equipment

	No.	Type	Length
Lifeboats	1		12′ 0″
Lifeboats	4		18′ 0″
Liferafts	2		

Propelling Machinery

Boilers

Number ... 4
Type ... Watertube
Length ...
Width or Diameter ...
Furnaces ...
Fuel ... Coal
Draft ... Natural or Forced
Total heating surface, square feet ... 8,000
Totat grate surface, square feet ... 196
...
Superheat, degrees F. ... 200
Working pressure, lbs. per sq. in. ... 250
Normal fuel consumption:
Per day, tons ...
Per horsepower hour, pounds ...
Normal steam production:
Per hour per pound of fuel ... lbs.
Total per hour ... lbs.

Main Turbine

Number ... 1
Type, marine, impulse, condensing, rigid frame, three bearing ...
Horsepower ... 2,200
Speed, 3,000 R.P.M. at maximum horsepower ...

Main Generator

Number ... 1
Type, 3 phase, alternating current, direct connected to main turbine ...
Voltage ... 2,300-3,000
Operating speed ... 3,000 R.P.M.
Excitation, not to exceed 20 K.W. when delivering 2,200 H.P. ...
Weight, turbine and generator combined, approximately 60,000 pounds ...

Main Propulsion Motors

Number ... 2
Type, 3 phase, alternating current, induction
Voltage ... 2,300-3,000
Speed, stator winding for operating stern propeller 176 R.P.M. at 2,100 H.P. and bow propeller 132 R.P.M. at 100 H. P.
Weight, each motor ... 60,000 pounds

Auxiliary Turbo Generators

Number ... 2
Type, direct current, 3 wire generator, 110-220 volts, driven by an impulse turbine through double reduction gears
Capacity ... 125 K.W. each
Speed reduction, approximately 3,600 to 1,200 R.P.M. ...

Emergency Lighting

(1) Set operating at 110 volts.

Auxiliary Motors

Marine, direct current, compound or shunt wound, commutating pole, self ventilating type operating at 220 volts.

Propellers

Number ... 2
Type ... Four-bladed solid
Weight ...
Diameter ...
Pitch ...
R. P. M. ... Forward 132, aft 176
Projected area ...
Developed area ...

Auxiliary Machinery

(Number, Size, Type)

Machinery Space

Condensers (1) 4,000 square feet cooling surface ...
Air ejectors (2) two stage, steam operated type. ...
Feed water heater ... 1
Oil coolers (2) heat absorption, about 3,000 B.T.U. per minute ...
Oil strainers ... 2
Oil separator ... 1
Injectors (2), to operate against boiler pressure of 250 pounds ...
Air compressor (1), stationary, motor-driven type with a capacity of 15 cubic feet of air per minute ...
Electric heaters (2), 500 watt (115 volts) heaters for each motor ...
Pumps:
(1) Circulating, centrifugal, capacity 5,000 gal. per min., direct connected to 40 H.P. elect. motor ...
(1) Condensate, centrifugal, capacity 120 gal. per min., direct connected 5 H.P. electric motor. ...
(1) Salt water service, centrifugal, capacity 100 gal. per min., direct connected 5 H.P. electric motor ...
(1) Fresh water, rotary type, capacity 25 gal. per min., motor driven ...
(2) Oil, rotary type, capacity 50 gal. per min., motor driven ...
(2) Feed, vert. simplex, steam 10 x 7 x 24 inches. ...
(1) Fire and general service, horizontal duplex, steam, 12 x 10 x 10 inches ...
(2) Bilge, vert. simplex, steam, 7 x 7 x 12 inches. ...

---

motor, when run at normal full speed frequency and full load, will be approximately 70 percent. The combined power factor of the stern motor and bow motor when run at one-half load on each motor, will be not less than 70 percent when the generator excitation is reduced for the half load condition.

Each motor will be provided with two 500-watt (115 volts) electric heaters.

Control Apparatus for Main Units

The propulsion motors will function as follows:

Maximum field will be applied to the alternator and the stern motor started on its full speed winding. After it has accelerated, the bow motor will be started on its slow speed winding and the field of the alternator reduced to normal. The above connections will be reversed for backing. Slow to full speed will be effected by turbine speed variation and control. All ordinary maneuvering, including speed changes, stopping, starting and backing, will be controlled by two levers mounted on the control panel; one turbine lever (turbine throttle) for varying the turbine speed and one control lever for energizing, electrically through a controller, the solenoid-operated air break contactors which control the functioning of the main propulsion units. In addition to these control levers there will be an arrangement of interlocking, manual control levers for use in emergency.

A protective device will be installed in the circuits leading to each slow speed motor winding which will trip the line contactors in these circuits in case an overload occurs on either motor when operating on the slow speed winding. An emergency connection will also be provided so that in case one motor fails the other motor can be operated in either direction on its full speed winding.

Auxiliary Turbo Generators

Two direct current turbo generator auxiliary sets of 125 kilowatts capacity each will be provided. Each set will consist essentially of an impulse turbine and a direct current,

three wire generator, of 110-220 volts capacity, operated through double reduction gears.

The turbine will be of the horizontal multi-stage type, with a water rate of approximately 21 pounds per kilowatt hour with 250 pounds steam pressure, 200 degrees F. superheat at the throttle and 28½ inches vacuum.

The turbine will be equipped with an oil-operated governor which will function at two percent overspeed and an emergency governor will be provided which will effectively shut off the steam supply at an overspeed of 10 percent.

The reduction gear, will be of the double reduction, straight line drive type, the speed reduction being approximately 3,600 to 1,200 revolutions per minute.

Generator and turbine will be mounted on the same bed plate. The generator will be flat compounded with three wire connections, etc., and of sufficient capacity to handle a 25 percent unbalanced load. An overspeed governor will be fitted which will operate on 10 percent above normal. The generator will be of the self-ventilated type.

Suitable connections will be provided to a switchboard in such a manner that either turbo generator, or both in parallel, can furnish current to the auxiliaries and the lighting circuits. The latter are to operate at 110 volts. Auxiliary motors are to take current across the outside wires of the system and operate at 220 volts.

Auxiliary Motors

All auxiliary motors will be of the marine, direct current, combined or shunt wound, commutating pole, continuous rated, self-ventilated, splash proof type, operating at 220 volts. They will be direct connected, generally, to their respective auxiliaries by means of flexible couplings.

Lubricating Oil System

A lubricating oil system will be installed for the main turbo generator, main propulsion motors and the auxiliary turbo generators. The system will include two gravity tanks located in the engine casing and connected through a duplex strainer to all bearings and thence to a common sump tank located under the engine floor. Duplicate oil pumps will draw from the sump tank through a duplex strainer and discharge through duplicate oil coolers to the gravity tanks, and connections will be fitted for by-passing the gravity tanks and discharging direct to the bearings through the strainer. The overflow from the gravity tanks will lead direct to the sump tank. In addition an independent line will be provided from the bottom of the sump tank to a pump discharging to a separator and then back to the sump tank.

Air Compressor

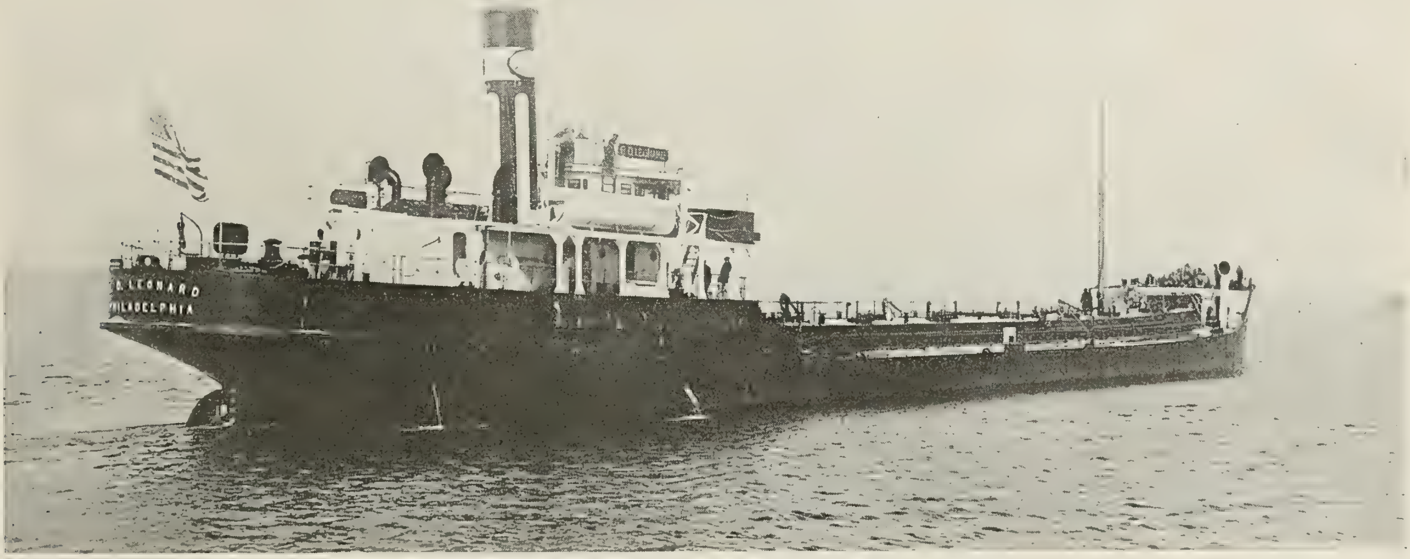
A single air compressor will be provided for blowing out coils, cleaning electrical machinery, etc. It will be of the stationary, motor driven, automatic control type with a displacement of approximately 15 cubic feet of air per minute.

The new ferryboats, when added to the present St. George ferries operating from the Battery, will add considerably to the facilities afforded for passenger and freight transportation to Staten Island. These new boats will be faster than those now in operation and it is also expected that they will operate more economically, resulting in a saving of from 20 to 22 tons of coal per day. The completion of the new municipal piers will increase in a very large measure the trucking traffic to the Island but these new, large and speedy ferryboats of the four driveway type are expected to amply provide for the efficient handling of this traffic.

Atlantic Refining Company Tanker R. D. Leonard Completed

ANOTHER vessel was added to the Atlantic Refining Company's fleet when the turbine driven single screw tanker *R. D. Leonard* was delivered to the company by the Harlan plant, Wilmington, Del., of the Bethlehem Shipbuilding Corporation, Ltd., on February 17.

The ship was built in accordance with Lloyd's 100 A-1 class for vessels to carry oil in bulk. The total carrying capacity is about 2,640 tons deadweight on a mean draft of 17 feet 1⅞ inches, with an oil cargo capacity of about 2,450 tons.



Atlantic Refining Company's New Tanker R. D. Leonard

The principal particulars of the vessel are as follows:

Length overall	276 feet 10 inches
Length between perpendiculars	266 feet 0 inches
Beam molded	39 feet 0 inches
Depth molded	20 feet 0 inches
Type of engine	Turbine
Boilers	Babcock & Wilcox
Number of boilers	2
Steam pressure, pounds per square inch	225
Kind of fuel	Oil
Speed on trial trip, knots	9.68

The propelling machinery consists of a single De Laval steam turbine, with double reduction gears, capable of de-

veloping a normal shaft horsepower of 750 at 95 revolutions per minute, and a maximum shaft horsepower of 900 at about 101 revolutions per minute. The Bethlehem-Dahl mechanical oil burning system is installed, operating under either natural or forced draft.

The oil pumping machinery consists of the following: Two vertical duplex compound cargo pumps, 7 inches by 12 inches by 10 inches by 12 inches stroke; fuel oil transfer pump, horizontal duplex type, 6 inches by 5¾ inches by 6 inches stroke; and two fuel oil service pumps, horizontal duplex type, 4½ inches by 2¾ inches by 4 inches.

The main feed pump and general service pumps are both vertical simplex, 10 inches by 6 inches by 18 inches stroke.

The deck machinery was built at the Moore plant of the Bethlehem Corporation, at Elizabeth, N. J., and consists of an 8-inch by 7-inch spring quadrant type steering gear with horizontal engines; an 8¼-inch by 8-inch spur-gear windlass; and a 6¼-inch by 8-inch steam self-contained gypsy-capstan.

Steam Pilot Boat Maryland Completes Her Trials

THE new steam pilot boat *Maryland,* built for the Association of Maryland Pilots, at the Tebo plant, Brooklyn, N. Y., of the Todd Shipyards Corporation, from the designs and specifications of Cox & Stevens, naval architects, New York, was given a successful trial trip at sea off New York harbor on March 29. The *Maryland* will be put in service as the station vessel off Cape Henry.

Pilot Boat Maryland

Principal Dimensions

Length over all	150 feet—0 inches
Length between perpendiculars	140 feet—3 inches
Beam molded	25 feet—0 inches
Depth molded	15 feet—7 inches

Intended for Steam Trawler

The vessel was originally designed as a steam trawler by Cox and Stevens. After construction was started she was purchased in an incomplete condition by the Association of Maryland Pilots. The design was then revised so that the vessel as now completed represents, both in construction and equipment, an ideal type of pilot boat.

The hull is constructed of steel in excess of Lloyd's requirements. The vessel has two pole masts and is flush decked with a straight stem and a turtleback forward. She has a well proportioned elliptical stern aft, the freeboard being ample and the sheer unusually lively.

There is a continuous steel deck house on the main deck. At the forward end of the main deck house there is a pilot house containing the captain's room and navigating room.

At the after end is a large smoking room comfortably furnished with tables, seats, and so forth, which communicates directly with the pilots' living quarters which are on the deck below.

Forward of the smoking room on the starboard side is the chief engineer's stateroom and on the port side a stateroom for the assistant engineer, both communicating directly with the machinery space which is just forward of their staterooms.

The steering engine is located on the main deck just forward of the machinery compartment.

Forward of the boiler enclosure is the galley and the pantry and at the extreme forward end of the house is the main room, which is handsomely furnished and of sufficient size to permit ample accommodations for the pilots.

The space under the turtleback forward contains the capstans and also the lavatories and toilets as well as storerooms for deck supplies and other equipment.

At the after end of the main deck over the quadrant are fitted large stern gratings and there is a very heavy towing bitt as well as the usual equipment of chocks, bollards and cleats.

Pilots' Quarters

Below deck, the pilots' main living quarters occupy the after part of the vessel and are unusually large and comfortably arranged. In this compartment are accommodations for sixteen pilots, each having a separate bunk and locker space for clothes. A bath room and ample wash facilities are provided.

Crew's Quarters

Below, forward of the boiler room, are the quarters for the crew proper and also accommodations for apprentices. On the starboard side is a large refrigerator, the ice machine room being adjacent thereto and also staterooms for stewards, messman and cabin boy, while on the port side are staterooms for the oilers and firemen as well as a large storeroom for provisions.

In the lower forecastle, which is arranged for apprentices and for additional members of the crew, are ten berths with the usual transoms and clothes lockers. Forward of this space is a storeroom with chain locker underneath.

Machinery

The engine, which is of the compound type, having cylinders 18 inches and 38 inches in diameter with a 26-inch stroke develops 650 horsepower. Steam is supplied by a Scotch boiler 14 feet 6 inches in diameter and 12 feet in length. The boiler has three furnaces and 2,500 square feet of heating surface. A donkey boiler is also installed.

Auxiliary Machinery

The following auxiliary machinery is installed:

Circulating pump—centrifugal type—6-inch discharge.
Feed pump—horizontal duplex type—$7\frac{1}{2} \times 5 \times 10$.
Donkey pump—vertical duplex type—$7\frac{1}{2} \times 4\frac{1}{2} \times 8$.
Fire and bilge pump—horizontal duplex type—$7\frac{1}{2} \times 4\frac{1}{2} \times 8$.
Fresh water pump—horizontal duplex type—$4\frac{1}{2} \times 3 \times 4$.
Generator—10 kilowatt—and storage batteries.
Ice machine—one-ton capacity.

Navy Machinery Specifications.—The Bureau of Engineering, of the Navy Department, is furnishing the Engineering Schools of many of the colleges of the country with copies of its General Specifications for Machinery. These specifications represent modern practice in naval engineering, and with their several appendices describing methods of inspection, etc., are practically text-books on this highly specialized subject.

Fig. 1.—S. S. Peninsula State, the Last of a Group of 535-Foot Passenger Vessels Built by the New York Shipbuilding Corporation, Camden, N. J., for the Shipping Board, on Her Trial Trip Early in February. The Peninsula State Has Been Allocated to the United States Lines

America Develops New Atlantic Passenger Service

United States Lines to Operate Nine "State" Ships Specially Adapted for Passengers of Moderate Means—Equivalent of Second Class Accommodations Offered to Pasesngers at Third Class Rates

ONE of the features of transatlantic passenger traffic this year will be the facilities afforded European travelers by the United States Lines to sail in American ships.

This farsighted steamship agency has arranged to operate nine Shipping Board vessels of the "State" class on the North Atlantic run and in addition to providing cabin accommodations of the highest type will cater particularly to passengers of limited means who contemplate going abroad. The vessels will be arranged to maintain a bi-weekly schedule to Europe and this will be increased to three sailings weekly should conditions warrant.

Plans for reconditioning the vessels with a view to increasing the comfort of passengers and extending the accommodations to allow for substantial reductions in rates have been prepared under the supervision of Mr. Carl E. Petersen, naval architect for the United States Lines.

Vessels Being Reconditioned

At the present time the *Old North State* and *Panhandle State* are cabin ships, and the *Centennial State* carries cabin and third class. The *Granite State* and *Blue Hen State* will each carry 176 cabin and about 400 third class in rooms, both of these ships being scheduled to sail in June. The *Lone Star State* and the *Peninsula State* carry about 205 first class and 234 third class passengers and the *Hawkeye State* and the *Buckeye State* will be fitted up to carry 250 first class and 320 third class passengers.

The conversion of the *Old North State* has recently been completed at the Morse Dry Dock and Repair Company's plant at Brooklyn, N. Y., and this vessel entered the New York-Plymouth-Cherbourg-London service on March 14. The work on this vessel is similar to that proposed for the cabins of the 502-foot class vessels and the changes consisted chiefly in removing one of the two beds from each room and substituting a sofa bed at the outboard side ingeniously arranged to accommodate two persons and installing a folding Pullman berth over the remaining bed. The new arrangement is shown in Fig. 2 and by this means accommodation is provided in each room for 1, 2, 3 or 4 persons.

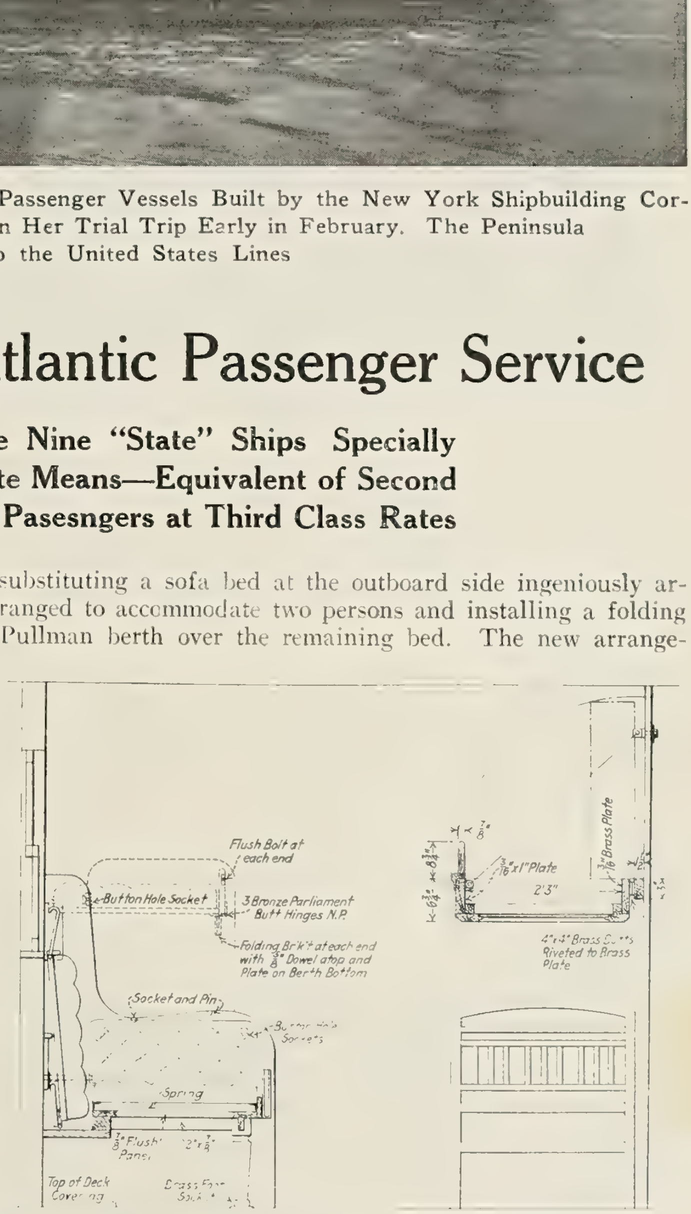


Fig. 2.—Typical Section, Showing New Arrangement of Cabin Staterooms

Changes in Third Class Accommodations

The most radical changes are being made in the third class accommodations. It is generally known that the greatest returns to a steamship company are made from the lowest class accommodations and on account of this the pre-war

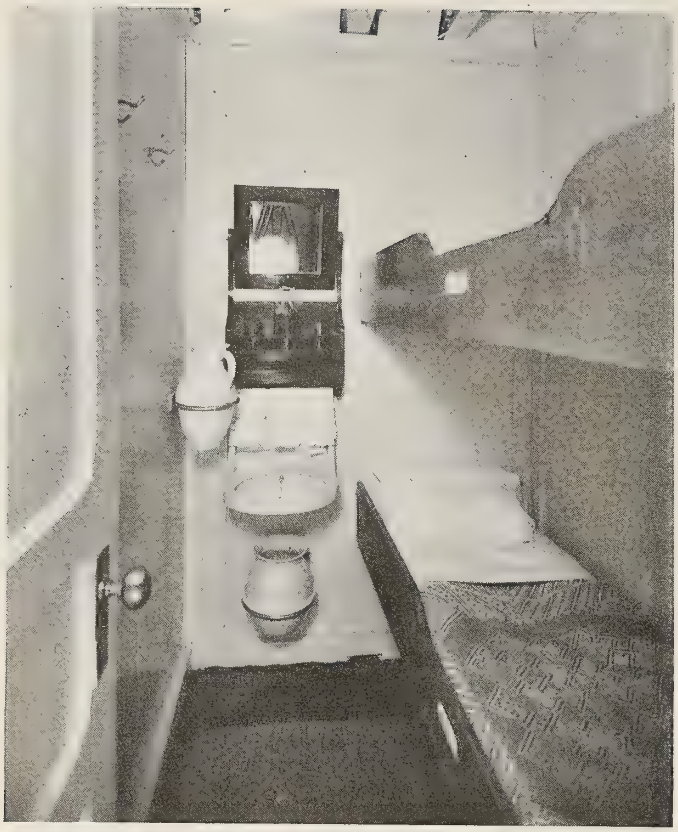


Fig. 3.—S. S. Lone Star State—Typical Third Class Stateroom

custom was to provide accommodations for the greatest number and the comforts afforded were a minimum. This has all been changed under the new plans of the United States Lines and in these American ships every means will be provided for adding to the comfort of this class of traveler.

The old time steerage quarters have been replaced with neat staterooms arranged for two, three, four or six persons and fitted with lavatories and other conveniences. The decks are covered with carpet and composition decking and built-in berths with hardwood leeboards and metallic springs are provided.

Public Rooms

In addition to the individual staterooms there have been provided for the third class passengers public rooms, including a ladies' lounge and a smoking room for men. Well filled bookcases, a victrola and a piano add to the facilities for pleasure. A large dining room is provided and a feature of this room is the substitution of swivel chairs for the long benches which were formerly used. The piano is located in this room and arrangements are made for removing the chairs and tables, in this manner providing a clear deck space for dancing. A barber shop adds to the conveniences offered and ample promenade deck space is provided for outdoor lounging and recreation.

Every need of the prospective passenger has been considered. The decorations have been studied and adapted to please the most fastidious. Upholstered settees invite one to rest and the whole scheme has been worked out to such a nicety that what is really offered is second class accommodations at third class rates.

Old-Fashioned Steerage Abolished

This new idea is bound to meet with universal approval and many who have hesitated about undergoing the hardships of a steerage passage to Europe will now find it within their means to go abroad in American ships and be assured of every comfort.

Not of the least importance in the new plans of the United States Lines is the reduction in price afforded. One can now travel in comfort to Queenstown, Plymouth or London for $85.00 or to Bremen for $103.50.

The plans and specifications for the conversion of these vessels were prepared by the technical staff of the United States Lines and the work is being supervised by Mr. Petersen, their naval architect, in collaboration with Mr. A. D. Woods of the Shipping Board. The work on the *Lone Star State* was completed on March 17, that on the *Peninsula State* on April 16 and that on the *Centennial State* on April 28 at the Robins Dry Dock and Repair Company's plant in Brooklyn.

Every effort is being made by the Shipping Board through Mr. T. Rossbottom to provide an incentive for Americans to sail in American ships and, while the cost of reconditioning this fleet involves a heavy expenditure, it is expected that a return more than offsetting it will be derived from increased patronage. That such will be the case is already indicated by the increasing demands for reservations which are constantly coming in.

The vessels of the United States Lines are already booked solid for passage to Europe until the 26th of July and practically full bookings are carried for the return trip extending to the middle of October.

Fig. 4.—S. S. Lone Star State—Third Class Ladies' Lounge

Fig. 5.—S. S. Lone Star State—Third Class Smoking Room

Motorship Hauraki Built for the Union Steamship Company of New Zealand

Large British Steamship Companies Build Motorships

First Diesel-Engined Vessels Completed for Union Steamship Company and Royal Mail Steam Packet Company

By Our Special London Correspondent

In spite of the shipbuilding depression in Great Britain and the fact that no orders of any consequence have been placed during the past twelve months, an increasing number of motorships have been completed, since orders were placed two years ago or more which have not yet been fulfilled.

The *Hauraki,* which ran her trials in the Clyde in March, is the first oil engined ship built for the Union Steamship Company of New Zealand (owners of 82 steamers), and it is understood that she will trade between Vancouver and New Zealand, being the first ship with internal combustion engines to be placed on this route.

Cargo Motorship Hauraki

She was built by William Denny & Brothers, Dumbarton, and in general hull form and dimensions is practically identical with the motor passenger liner *Domala,* of which a full description was published in the February issue of this journal. The *Hauraki,* however, is purely a cargo ship on which none of the passenger accommodation of the *Domala* is included.

The main dimensions are as follows:

Length overall	464 feet
Length between perpendiculars	450 feet
Maximum beam	58 feet
Depth to the upper deck	35 feet 6 inches
Deadweight capacity, including fuel	10,850 tons

Comparison With Similar Steamships

The engine room is amidships and there are two cargo holds forward and two aft. In the double bottom is carried oil fuel to the extent of about 1,000 tons, which will give a radius of action of some 18,000 miles. As the vessel will be engaged upon long distance services, this large radius of action is an asset of considerable importance and the *Hauraki* will be able to bunker at San Francisco, where oil prices are low, and make the round voyage to New Zealand and back without having to take on more fuel.

It is interesting to note that the machinery of the *Hauraki*

Royal Mail Steam Packet Company's Motorship Lochkatrine

weighs approximately the same as that of a corresponding steamer including the boilers, but in the motor vessel there is an additional cargo capacity due to the absence of bunkers, this representing an extra profit earning space of several thousand cubic feet.

Air Compressors Driven from Main Engines

In many respects the machinery installed in the *Hauraki* is similar to that fitted in the *Domala*. In the latter ship, however, it was essential to obtain the maximum horsepower on the shaft with a given cylinder dimension and it will be remembered that for this reason the injection air compressors were not driven off the main engines but coupled to separate Diesel motors. In the *Hauraki*, engines of the same size as those installed in the *Domala* are used but they drive their own air compressors so that although the indicated power of the machinery of the two ships is the same, the effective or shaft horsepower in the *Hauraki* is some ten percent less, this being absorbed by the compressors.

A further result of this rearrangement is that the auxiliary machinery in the *Hauraki* is simplified and the only air compressing plant beyond that on the main propelling engines is an electrically driven compressor coupled to a 230 horsepower motor.

Propelling Machinery

The propelling engines were built by the North British Diesel Engine Works at their new factory erected specially for the construction of marine Diesel machinery. The four-cycle principle is adopted and the motors are of the eight cylinder type with cylinders 26½ inches bore and 47 inches stroke. The low speed of rotation, namely 96 revolutions per minute, at full power is noteworthy in view of the fact that in most four-cycle Diesel engines of this output the speed is about 115 revolutions per minute.

The chief novelty in the detailed design of these engines, and it is one which has not attracted altogether favorable comment, is that in reversing, before the valve levers can be brought over the astern cams, the camshaft is allowed to fall bodily and then move fore and aft. The system has, however, worked satisfactorily on the *Domala* and is apparently completely successful in service. The arrangements of the injection air compressors have never previously been adopted and it is interesting to see that each engine has two three-stage compressors driven from the crankshaft by a connecting rod of V-section. On trials a speed of 13¼ knots was attained but the average sea speed will be in the neighborhood of 12½ knots when it is anticipated that the fuel consumption will not exceed 14 to 15 tons daily.

Like the vast majority of British built motorships, the auxiliary machinery on the *Hauraki* is wholly electrically driven. The generating plant comprises three 200 brake horsepower four cylinder Diesel engines of the North British type, driving 220 volt dynamos. At sea one set will be sufficient for all purposes. When loading or discharging cargo two plants will be required, so that one will always stand in reserve. The cargo handling machinery is exceptionally complete and 12 electric winches are fitted on deck.

Two further sets of twin screw machinery of exactly similar type to that installed in the *Hauraki* are now being built by the North British Company, one for a cargo ship and the second for a motor passenger liner for the British India Steam Navigation Company.

The Lochkatrine—a 14,000-Ton Motorship

Since the middle of February of this year no fewer than four standard motorships, each of 14,000 tons deadweight, have been completed on the Clyde. This is an indication, first, of the way in which standardization in oil engine building is proceeding and, secondly, of the confidence now felt in large motorships. Apart from the fact that some of them are intended for special trades and have larger refrigerating capacity than others, they are identical in every detail and the cost of construction is thereby reduced.

One of these ships, the *Lochkatrine*, of which an illustration is reproduced, represents the Royal Mail Steam Packet Company's first incursion into motorship owning. In conjunction with their associated concern, the Holland-America Line, they are building six motorships of the same size and type, all of which are destined to trade between London and Pacific Coast ports via the Panama Canal, a new service which the Royal Mail Steam Packet Company is now opening out. Clearly British shipowners are attacking the motorship problem in no niggardly spirit.

The following are the main details of the *Lochkatrine:*

Length overall	502 feet
Length between perpendiculars	485 feet
Maximum beam	62 feet
Depth	38 feet 6 inches
Gross tonnage	9,500
Deadweight tonnage	14,000
Indicated horsepower	6,400
Speed, knots	13-13½

There is comparatively little to be said concerning the machinery installation of the *Lochkatrine* as it represents the standard Burmeister and Wain practice as followed by the builders, Harland and Wolff. The two eight cylinder engines of 3,200 indicated horsepower each have cylinders 740 millimeters diameter and 1,150 millimeters stroke, the propeller speed being 115 revolutions per minute. Fuel consumption, including the oil required for driving the auxiliary machinery, works out at 20 tons daily, which is rather less than a quarter of the weight of coal needed in a corresponding coal fired steamer.

Electrical Equipment

The engine room represents something in the nature of a small central electric generating station for there are no fewer than four 100 kilowatt generators coupled to three cylinder Diesel engines of 150 brake horsepower. At sea, although one engine is sufficient to supply the power required for the auxiliary generating plant, two are actually kept in operation as it is considered that by running them on light loads their life is prolonged and the attendance necessary is considerably decreased. It is true that the fuel consumption is slightly higher than it otherwise would be, since it is clearly uneconomical to run Diesel motors at about one-third full load but in any event the oil required for this purpose is so small that the point is insignificant.

On deck, where all the winches are electrically operated, there are seven of the new four barrel type known as the McFarlane design which are capable of working four derricks at a time. Eight 7-ton electric winches of the ordinary pattern are also fitted on deck and the anchor windlass, steering gear and all engine room pumps are coupled to electric motors. There is only a small heating boiler installed which is kept in operation when the ship is in a cold climate.

The other three sister ships which as previously mentioned have been in commission since February, are the *Dinteldyk* for the Holland-America Line, and the *Glengarry* and *Glenbeg* for the Glen Line, which already has two vessels of the same size in regular service.

Shipping Board Vessels to Be Named After Presidents of the United States

THE Shipping Board has decided to rename the 502- and 535-foot passenger and cargo ships now named with state nicknames, such as *Nutmeg State*, and also the *Leviathan*, after presidents of the United States. Eighteen ships are to be renamed, not including the *George Washington* and the *America*, nor four ships in South American service, the *Southern Cross*, the *Western World*, the *Pan-American*, and the *American Legion*.

Mauretania Converted Into an Oil Burner

Improvement Reduces Boiler Room Force by 228 Men and Shortens Time of Fueling from 3 Days to 7 Hours

THE famous Cunard liner *Mauretania,* which was built by Swan, Hunter and Wigham Richardson, Limited of Wallsend-on-Tyne, England, and delivered to her owners in the fall of 1907, has recently arrived in New York on her maiden voyage as an oil burner. The work of converting this vessel to an oil burner was assigned to the Swan, Hunter and Wigham Richardson yard last September and it took a little less than six months to complete the job.

In addition to the oil burning system, the ship underwent extensive repairs and alterations. There had been a fire on board the ship when she was at Southampton last summer, which destroyed a few cabins on the deck below the first class dining room. All of this accommodation was restored. The whole of the dining room deck, however, had to be dismantled, the steel plates removed and the deck beams taken out and made fair. The whole of the beautiful carved oak panels and pillars in the magnificent dining hall were taken down and scraped and finished with beeswax polish, this restorative greatly enhancing its beauty. A large amount of similar work was done to the music room and lounge, the smoking room, the library, the second class public rooms and to a large number of staterooms.

Holds the Speed Record

The speed record of the *Mauretania* has been unsurpassed. Messrs. Swan, Hunter and Wigham Richardson, Limited, originally contracted to guarantee a round voyage across the Atlantic and back, under picked conditions, at 24½ knots. The performance of the ship greatly exceeded expectations, for in one year she did 27 consecutive trips acrosss the Atlantic in all weathers, at an average speed of 25½ knots. Her fastest voyage all the way across the Atlantic averaged 26.06 knots, 27 knots being run for one whole day. No other ship has been able to touch this performance, which is a very remarkable record.

As the competition in speed between rival shipowning companies in the North Atlantic has died down, it is quite possible that the Cunard Steamship Company will not try to see what is the highest speed at which the *Mauretania* can run with oil fuel. All the same, it is certain that she can show an even better performance than her record of 26.06 knots average speed across the Atlantic, if required.

Principal Characteristics

Length over all	790 feet 0 inches
Breadth	88 feet 0 inches
Molded depth to shelter deck	60 feet 6 inches
Draft to freeboard	36 feet 2½ inches
Launching weight including cradle	16,800 tons
Gross tonnage	32,000 tons
Displacement tonnage	44,640 tons

Main propelling engines—2 high pressure and 2 low pressure ahead turbines, and 2 astern Parsons turbines, 180 revolutions per minute.

Boilers—23 double ended and 2 single ended cylindrical boilers working under Howden's forced draft, with a steam pressure of 195 pounds per square inch.

Number of furnaces	192
Grate area	4,060 square feet
Heating surface	150,000 square feet

The boilers are divided into four groups, each in a separate watertight compartment. The uptakes lead to four elliptical funnels. The whole range of the boiler rooms is protected on each side by continuous watertight bunkers, which have now been made oiltight to carry oil fuel.

The former coal carrying capacity of the side bunkers, including a forward cross bunker, was about 6,000 tons. The oil carrying capacity of the side bunkers alone is now 5,350 tons. This excludes the forward cross bunker which is not used for fuel.

The installation of oil burning apparatus was carried out by the Wallsend Slipway and Engineering Company, the builders of the ship's turbines and boilers. The oil burning apparatus is of the Wallsend-Howden system, which has a world-wide reputation for high efficiency.

Oil Burning Installation

Each boiler room has a transfer pump to bring oil to a settling tank which is provided with heating coils to bring the oil to a proper degree of fluidity before it is passed to the burners. In each boiler room there is a spare heating and pumping unit as a standby. Oil is loaded into the ship at four points, two on each side above the main deck. There is a wonderfully complete set of piping and valves, so that oil may be supplied to or pumped from any one tank at will. Air escape pipes are fitted to every oil tank and they can also act as overflow pipes with connection to the main pipe lines on each side of the ship.

The ship had accommodation for 198 firemen and 120 trimmers.

Owing to the fact that the ship is now burning oil fuel, the total number of boiler room attendants will now be only 90. This means dispensing with the services of no less than 228 men, which is a remarkable economy in addition to the greater efficiency gained in the consumption of fuel by the use of oil burners.

The *Mauretania* can now be fueled in seven hours as compared with three full days for coaling. This permits her to make a complete turnaround every three weeks whereas under coal it required four weeks. With oil stowage, some of the space formerly occupied by the coal bunkers is made available for other purposes. This is also true of the space occupied by the 228 extra men that are necessary to man the ship as a coal burner so it is apparent that, even if the price of oil is increased to a point where it would be more economical to burn coal in a freight ship, the advantages of space, personnel and turnaround would still favor the use of oil in the large express liners.

120-Ton Sperry Gyro-Stabilizer to Be Installed in Hawkeye State

A GROUP of prominent naval architects and shipping men were given an opportunity to witness a test of a 120-ton Sperry gyro-stabilizer at the plant of the Westinghouse Electric and Manufacturing Company at South Philadelphia on Thursday, April 13. This stabilizer is to be installed in the Shipping Board steamer *Hawkeye State,* which is now running between Baltimore and Honolulu.

At a luncheon which preceded the inspection, the inventor, Mr. Elmer A. Sperry, explained that it was possible for a relatively small stabilizer to control a large ship and keep her on an even keel because it absorbed the wave increments at their inception. Rolling, he asserted, was due to a piling up of wave increments but the stabilizer prevented such an accumulation of forces and, for this reason, it could be placed most anywhere in a ship without unduly stressing the structural members of the vessel.

Southern Pacific Oil Tanker Tamaihua, of 17,200 Tons Deadweight

Southern Pacific Oil Tanker Tamiahua

Largest Merchant Vessel Built on the Pacific Coast —Details of Propelling Machinery—Trial Trip Data

By Henrik Greger*

THE continued demand for oil in the past few years gave impetus to great activity in the building of tanker tonnage by many of the various oil companies. The Southern Pacific Railway Company, which uses oil-burning locomotives exclusively and has a large number of oil-burning vessels, recently added to its fleet the S. S. *Tamiahua* built by the Moore Shipbuilding Company, Oakland, Cal. The vessel was designed and constructed under the supervision of A. S. Hebble, superintending engineer of the Southern Pacific Company-Atlantic Steamship Lines, and represents the most advanced ideas and practices in tank ship design.

The vessel has a total deadweight carrying capacity of 17,200 tons and is of the following general dimensions:

Length overall	516 feet 4 inches
Length between perpendiculars	500 feet
Depth molded	39 feet
Beam molded	71 feet
Mean draft	29 feet 3 inches
Speed	11 knots

The propelling machinery located aft, with separate engine and boiler rooms, consists of a vertical inverted quadruple expansion engine built by The Hooven, Owens, Rentschler Company, Hamilton, O., especially designed for the vessel.

The vessel is a single screw tank ship of the shelter deck type, with straight stem and elliptical stern, rigged with three steel pole masts. There are complete steel shelter, main and lower decks with an expansion trunk in way of the oil tanks.

The hold is divided into ten tanks with a centerline bulkhead extending under deck, dividing the tanks into port and starboard compartments. The wing spaces between the main and upper deck in way of the main oil tanks are divided into six compartments on each side and fitted as summer tanks. The pump room is located amidships. A fuel oil tank is fitted between the cargo tanks and the boiler room with a cofferdam between the fuel tanks and the boiler room. A double bottom is fitted in the engine room and boiler room for carrying fresh water or ballast.

Accomodations for the captain and deck officers are provided in a double tier of steel deck houses amidships. These houses are raised 3 feet 6 inches above the deck in order to be free of any gasses that might leak through the tank tops. The wheel house and chart house are of steel, built on top of the upper house. Quarters for the engineers, firemen, messrooms, etc., are provided in a steel deck house on the shelter deck abreast of the engine casing. The galley is located aft of the machinery casing on the shelter deck. Quarters for petty officers, seamen, cold storage, hospital and storerooms are located at the after end of the upper deck abreast the machinery casing. A steel house is provided on the after shelter deck fitted with an auxiliary steering gear. The top of this house is fitted with a warping bridge.

The vessel is built on a combined system of longitudinal and transverse framing of the Isherwood system, with scantlings and material as required by the American Bureau of Shipping classed A-1.

Cargo Oil Pumps

The cargo oil pumps consist of two horizontal duplex compound pumps with cylinders 19 by 30 by 16½ by 24 inches. Each pump is capable of discharging 3,500 barrels of oil per hour. The pumps have 18-inch suctions and 14-inch discharges. They take suction for a 14-inch main from both the forward and after ends of the vessel, which gives an exceptionally low velocity of oil in the suction lines. These pumps are designed with large valves and have 135 percent valve area in the oil ends. In addition, there is a stripping pump of the vertical duplex type, 16 by 10 by 18 inches, connected to an independent system of piping for stripping the cargo tanks to a lower level than it is possible to take the oil with the main pumps. The fuel oil feed pumps are of the horizontal duplex type, 7½ by 5 by 10 inches.

There are three single ended Scotch boilers with four furnaces in each boiler. The boilers are 15 feet 9 inches inside

*Chief engineer, Marine Department, Hooven, Owens, Rentschler Company, Hamilton, Ohio.

diameter, 12 feet long outside of the heads and are built for a working pressure of 230 pounds per square inch. The total effective heating surface of the boilers is 9,900 square feet. The furnaces are 41 inches inside diameter with 2¾-inch tubes. The boilers are fitted with heated forced draft and are arranged for burning oil.

There are two 84-inch forced draft fans manufactured by John Reid and Company, driven by twin 8 by 6-inch engines, with one engine in reserve. These fans are capable of producing 1-inch air pressure at the burners.

There are two main feed pumps of the vertical simplex type, 12 inches by 8 inches by 24 inches.

Auxiliaries

The main condenser has a cooling surface of 11,000 square feet and the auxiliary condenser a cooling surface of 6,000 square feet.

The main air pump is driven off the main engine and is 30½ inches diameter by 25½ inches stroke. The main circulating pump of 6,500 gallons capacity is driven by two vertical engines, each 10 inches diameter by 12 inches stroke. The auxiliary circulating pump, 5 inches in diameter, is driven by a 6½-inch by 6-inch vertical engine.

The bilge and sanitary pumps, each 6 inches diameter by 25½ inches stroke, are connected to the main engine. The feed pumps are of the independent vertical simplex type, 12 inches by 8 inches by 24 inches. The fire and bilge pumps are independent vertical duplex, 12 inches by 7 inches by 12 inches, and the sanitary pump is independent vertical duplex, 7½ inches by 5 inches by 10 inches. The evaporator feed pump, refrigerator, circulator and fresh water pumps are all duplicates, of the horizontal duplex type, 4½ inches by 2¾ inches by 4 inches.

The auxiliaries include two 15 kilowatt generator sets, a No. 30 Reilly multicoil feed water heater, two 35-ton evaporators, a 1,000-gallon distiller, a 3-inch twin grease extractor and two metropolitan injectors.

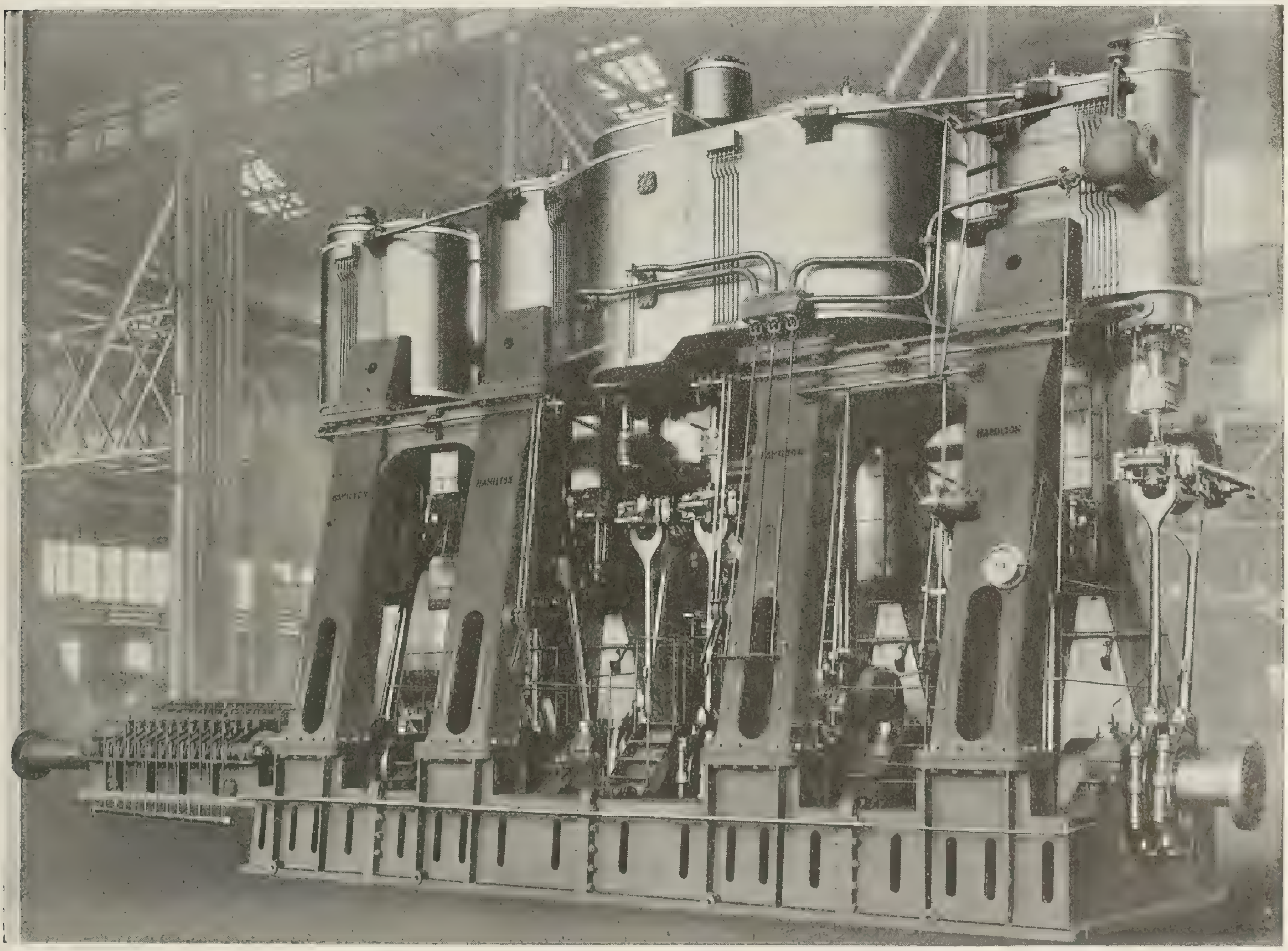
Main Engine

The cylinders of the main engine are 27½ inches, 40 inches, 59 inches and 86 inches diameter by 54 inches stroke. With a boiler pressure of 220 pounds per square inch the engine develops 4,200 indicated horsepower at 75 revolutions per minute.

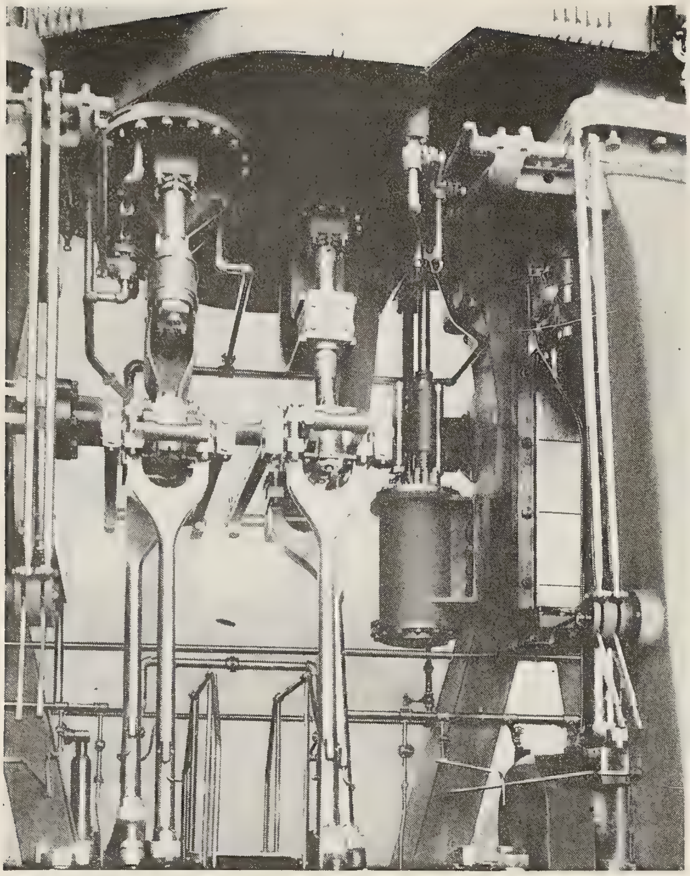
The arrangement of the cylinders from forward to aft is as follows: High pressure, low pressure, second intermediate and first intermediate. The cranks are balanced on the Yarrow-Schlick-Tweedy system offsetting the angles from the usual 90 degrees. This arrangement of the cylinders simplifies the receiver piping, reducing condensation to a minimum.

The high pressure, first and second intermediate cylinders are fitted with piston valves, the low pressure cylinder with a balanced slide valve. All piston valves are fitted with plain balance pistons on top and the slide valve with a Lovekin balance piston to counteract the unbalanced weight and inertia of the valve gear parts. The valves take steam as follows: High pressure, first and second intermediate inside and low pressure outside.

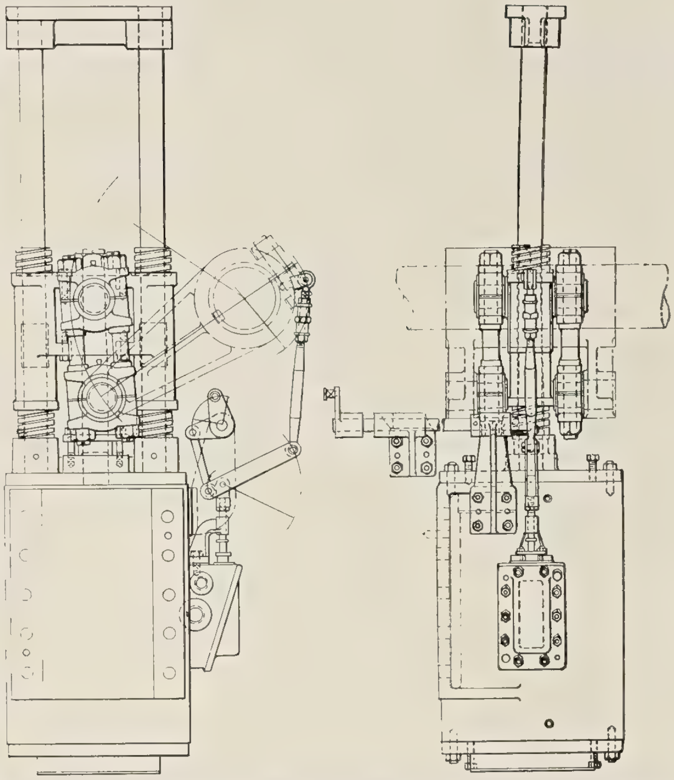
The pistons for the high pressure and first intermediate cylinders are made of cast iron and for the second intermediate and low pressure cylinders of cast iron. The low and second intermediate cylinders are bolted together with the



Main Engine of the Tamaihua Erected in the Builders' Shop



Arrangement of Reversing Engine



Front and Side Elevations of Reversing Engine, Showing Double Link Arrangement

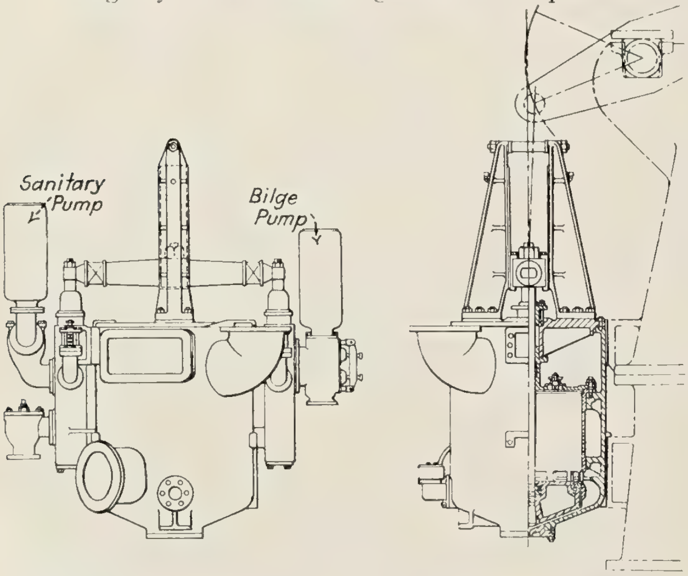
high pressure and first intermediate at either end and held by tie rods. This arrangement gives interchangeability to the crank shaft section, and eliminates outside receiver piping between the second intermediate and low pressure cylinders. The high pressure and first intermediate cylinder receiver pipes are made of copper fitted with expansion joints, which are provided with drain pockets for removing condensation.

The housings are box shaped, of cast iron, and arranged independent for each cylinder. The flanges for bolting to the bedplate and cylinders are liberally proportioned. Where the cylinders are independent, such as the high pressure and first intermediate, the housings are bolted together fore and aft for rigidity. The crosshead guides are independent and bolted to the face of the housings; they are provided with water circulation. The bedplate is made of cast iron in four sections bolted together. Cross girders heavily ribbed provide recesses for the main bearings. The bottom of the bedplate is flat for bolting to the ship structure.

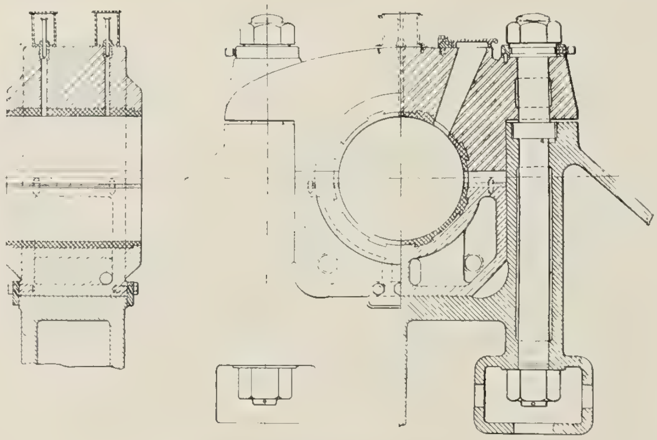
The air and bilge pumps are bolted to the second intermediate back housing and bedplate and are driven through a beam from the crosshead. The reverse engine, of the single ram type, is located on the aft side of the low pressure back housing. The turning engine, of the double cylinder type, is bolted to the forward side of the first intermediate back housing. The thrust is of the horseshoe type with bearings at each end; it rests on a separate casting, forming a foundation in line with the bedplate.

Construction Details

The crosshead construction is of the double slipper type with babbitted cast iron slippers bolted to the crosshead, the go-ahead side being on the back housing. The connecting rods are of the forked type with cast steel babbitted boxes on the crank end and bronze babbitted boxes for the crosshead



Arrangement of Pumps Attached to Main Engine, Showing Half Section of Air Pump



Details of Main Bearings

end, the usual provisions being made for providing taking up wear in all bearings.

The main bearing construction consists of a lower bronze babbitted box with cast steel babbitted cap, both fitted snugly into a recess on the bedplate. The lower box is cored for water circulation.

The crank shaft is built up in sections with the crank pins and shaft section shrunk onto the forged webs. The shaft is made in four interchangeable sections held together by reamed bolts.

Valve Gear

The valve gear is of the Stephenson link type. The eccentric sheaves are of cast iron in halves keyed to the shaft and held together by fitted bolts. The eccentric straps are of cast steel with babbitted face and fitted with shims for taking up wear. The eccentric rods have bronze boxes for attachment to the links. For "going ahead" the eccentric rods are arranged for "crossed rods," using long drag rods for connecting the links with the reverse shaft. The reverse shaft is located on the back of the engine and supported by babbitted bearings to the housings.

The reverse levers are of cast steel keyed to the shaft and fitted with slotted arrangement for adjusting cut-offs. The valve stems for the second intermediate cylinder, having two valves, are connected by a steel casting crosshead fitted with bronze liners operating on guides bolted to the cylinder.

Reverse Engine

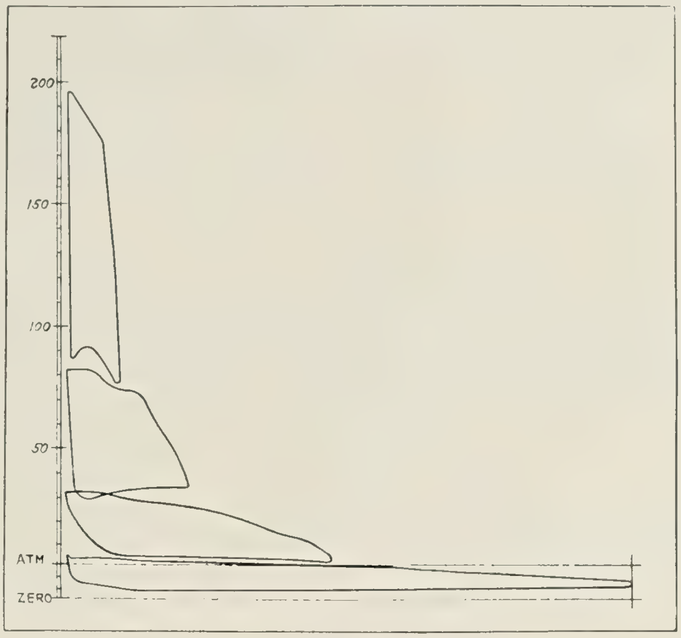
The reverse engine is of the single steam ram type, consisting of a steam cylinder operating an arm keyed to the reverse shaft.

The engine is bolted to the low pressure back housing. In order to avoid the usual long overhang, a scheme of bringing the cylinder close to the housing was evolved by a double link arrangement, and to absorb the extra thrust due to the short links a double guide bar was used. The follow up gear operating the slide valve is connected with the handling gear.

Attached Auxiliaries

The turning engine is of the double cylinder type fitted with Stephenson reverse links. It operates the main shaft through a double set of worm gearing. The disengaging is done by moving the worm out of gear with the wheel on the main shaft.

The air pump is of the Edwards single acting type driven from the main crosshead through beams. The pump body is of cast iron with removable bronze liner and cast iron bucket



Combined Indicator Diagrams

with bronze follower. The valve deck is of bronze with valves of excelsior fibre. The valves are accessible through an inspection door on the side of the pump body. The bucket rod of steel is attached to a crosshead which is guided by vertical brackets bolted to the pump cover.

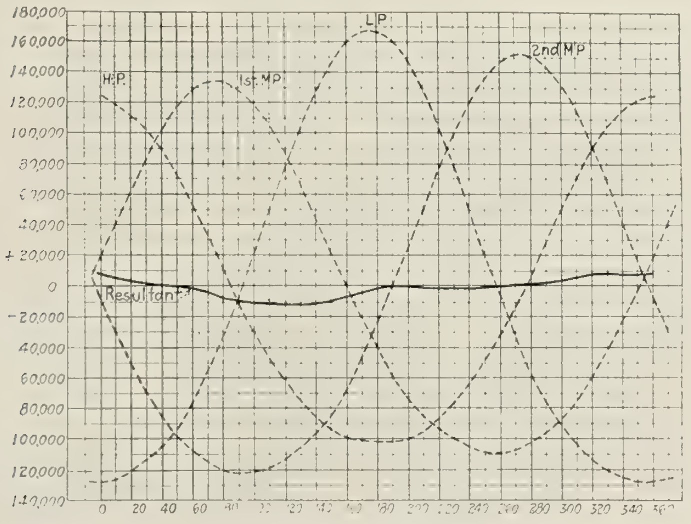
The bilge and sanitary pumps are bolted to the air pump, and the plungers are attached to the air pump crosshead. The bilge pump is fitted with leather clap valves and the sanitary pump with rubber valves. Air chambers and relief valves are provided as required for smooth operation and insurance against excessive pressures.

Handling and Operating Gears

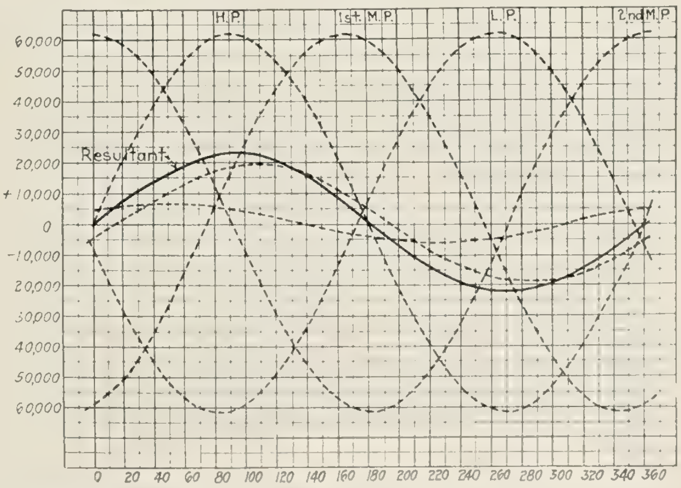
The throttle valve is of the double beat balanced type fitted with Monel metal seats. For quick control a butterfly valve is placed in the valve body close to the high pressure cylinder.

The steam chests of all cylinders are connected with the throttle for live steam connections. Operating levers for the throttle, reverse and drains are located on the starboard side and centralized around the low pressure housing within easy reach of the operator.

The oil cups for reciprocating parts are located on the front side of the cylinders and connected to the proper bearings



Vertical Inertia Forces of Cylinder and Valve Gear Rotating and Reciprocating Parts



Horizontal Forces of Cylinder and Valve Gear Rotating Parts

through pipes. Small bearings are provided with cups for hand oiling and the main bearings with wick oilers

Water service from the sea is supplied for the shaft bearings, eccentrics and thrust shoes. The guides are water cooled, by connection to the sanitary system. Ample provision is made for protecting the operators against the moving parts by guards, rails and covers, and steps are fitted over the shaft at convenient places. The eccentrics operate in oil-tight pans. Relief valves are fitted to the top and bottom of all cylinders and on all valve chests. There is also a system of drain piping attached to the cylinders and chests connected to the condenser or feed water system. The drain valves are operated from the lower grating.

Balancing of the Engine

The engine was designed with the view of obtaining the best balance, without any sacrifice in weight or strength. The cranks were arranged on the Yarrow-Schlick-Tweedy system.

The curves (page 311) show the effect of both vertical and horizontal forces due to cylinder and valve gear reciprocating and rotating parts. The resultants are well within practical limits for smooth operation.

Detail Dimensions

The principal dimensions of detail parts of the engine are as follows:

Diameter of crank shaft	16 inches
Diameter and length of main bearings	16 by 17 inches
Diameter and length of crank pin	16¼ by 16½ inches
Diameter and length of crosshead pin	8 by 9 inches
Length between centers of connecting rod	120 inches
Diameter of connecting rod—top and bottom	7 inches—8 inches
Length and width of crosshead slipper	30 by 18 inches
Diameter of high pressure piston valve—top and bottom	12 inches—11½ inches
Diameter of first intermediate pressure piston valve—top and bottom	21 inches—20½ inches
Diameter of second intermediate pressure piston valve—top and bottom (2)	21 inches—20½ inches
Diameter of piston rod	7½ inches
Diameter of valve stem stuffing box—guides	4½ inches—5 inches
Lineal clearance of cylinders—top and bottom	½ inch—⅝ inch
Diameter of steam pipe	10 inches
Diameter of exhaust pipe	30 inches
Diameter and length of link block pin	5 by 5½ inches
Diameter and width of eccentrics	33 by 5¼ inches
Diameter and length of eccentric rod pin	4 by 4 inches
Diameter of eccentric rods—top and bottom	3⅝ inches—4⅝ inches
Diameter and length of drag link pin	3 by 3½ inches
Width and height of link bar	2 by 6½ inches
Diameter and stroke of reverse engine	16 by 25 inches
Diameter of reverse shaft	8 inches
Diameter and stroke of turning engine, double	6 by 6 by 6 inches
Diameter of thrust shaft	16 inches
Diameter and number of collars of thrust shaft	27 inches—12
Thickness of thrust collars	2½ inches
Diameter and number of coupling bolts	2¾ inches—12

Trial Trip

On September 19, 1921, the trial trip was made and every part of the machinery worked successfully. A speed of 11.32 knots was obtained on a 28-foot draft with an indicated horsepower of 3,615 at 70 revolutions per minute.

Observations during the trial trip were as follows:

Steam boiler pressure	218 pounds per square inch
Pressure in high pressure steam chest	192 pounds per square inch
Pressure in first intermediate pressure receiver	86 pounds per square inch
Pressure in second intermediate pressure receiver	31.5 pounds per square inch
Pressure in low pressure receiver	5 pounds per square inch
Vacuum	24 inches
Temperature of feed water, inlet	122 degrees
Temperature of feed water, outlet	194 degrees
Back pressure in heater	5 pounds per square inch
Temperature of inlet sea water	55 degrees
Temperature of outlet sea water from condenser	118 degrees
Temperature of condenser exhaust	132 degrees
Temperature fuel oil to heater	62 degrees
Temperature fuel oil from heater	202 degrees
Pressure of fuel oil	150 pounds per square inch
Pressure forced draft	1¼ inches
Pressure forced draft at furnace	0.4 inch
Temperature of engine room	81 degrees
Temperature of boiler room	88 degrees

During the trial a check was made on the fuel consumption, which showed 11.8 barrels of oil per hour which is equivalent to 0.94 pound per indicated horsepower hour.

The builders' guarantees both as to speed and economy were fulfilled by liberal margins.

Maiden Voyage

The *Tamiahua* left San Francisco on September 29, 1921, on its maiden voyage through the Panama Canal to New Orleans. Great interest had been evidenced in this ship as it is the largest merchant vessel ever built on the Pacific Coast of the United States or in fact on the west coast of the Western Hemisphere. It also has the largest deadweight tonnage of any ship that ever sailed out of the port of San Francisco or into the ports of New Orleans and Galveston.

The voyage to Panama was uneventful as everything worked smoothly, the engine operating without vibration or any sign of heating of the bearings. The ship was water ballasted to 18 feet, mean draft, and maintained an average speed of 10½ knots, with the engine developing 2,725 indicated horsepower at 61.9 revolutions per minute. Sounding of the tanks indicated an oil consumption of 0.927 pound per indicated horsepower hour, with all oil consumed by the engine and auxiliaries charged to the main engine horsepower. Allowing for auxiliaries this gives 0.86 pound of oil per indicated horsepower hour used by the main engine alone.

From Panama the ship proceeded to New Orleans under an average speed of 11 knots with the engine developing 3,100 indicated horsepower at 65.9 revolutions per minute. The fuel consumption from sounding indicated 0.96 pound of oil per indicated horsepower hour with all oil used charged to the main engine or 0.89 pound deducting for auxiliaries. The oil used was 18.9 Baume gravity.

The vessel recently made a voyage from Port Lobos, Mexico, to Philadelphia and delivered at the latter port 115,092 barrels of 20 gravity oil. The distance covered on the voyage was 2,010 nautical miles with the main engine averaging 65 revolutions per minute and indicating 3,255 horsepower, including auxiliaries. The fuel consumption per indicated horsepower hour, including auxiliaries, amounted to 0.948 pound. The oil used was Mexican crude of 12 Baume gravity with a caloric value of 17,400 British thermal units. The total oil consumption per day was 33.07 tons and the average speed 10.63 knots.

Shipping Board to Open Freight Offices in Middle West.—In accordance with plans which have been under consideration for some time, the Shipping Board Emergency Fleet Corporation will open shortly a series of freight offices at Cincinnati, Memphis, Kansas City, Chicago, Detroit and Minneapolis, which will report to a manager of interior offices with headquarters in Washington. The managers of these interior offices are to work for the development of the American merchant marine by keeping in touch with local business organizations and with possible shipments, but will not themselves pick cargoes.

Twin Screw American Motorship William Penn

William Penn Completes Voyage Around the World

Motorship Demonstrates Reliability of Diesel Engine—Striking Fuel Economies Recorded for Main and Auxiliary Machinery

THE *William Penn* has the distinction of being the first large American motorship suitable for the deep sea cargo trade. She is owned by the Shipping Board and operated by the Barber Steamship Lines.

On March 19 she completed her maiden voyage around the world of 28,500 miles, and has completely demonstrated the reliability of the Diesel drive and the great economic superiority of the motorship over the steam-driven vessel.

On her arrival back in New York, the propelling machinery was found to be in perfect condition, with no expenditures whatsoever required for repairs. The exhaust and inlet valves of the main engines were changed only once which was at the middle of the voyage. All work on the main engines, which was of a routine nature, was done by the engineer personnel when in port, and all similar work on the auxiliary engines and machinery was done while under way, at sea. The auxiliary engines worked perfectly throughout the trip, and were run at times over 500 hours without stopping. There was no involuntary stopping of the vessel at any time throughout the voyage.

The motorship *William Penn* is 455 feet overall, 445 feet between perpendiculars, and 60 feet beam, with a designed draft of 28 feet, 4¾ inches, loaded, corresponding to 12,375 tons deadweight, and 17,100 tons displacement. The description of the machinery has been given previously and is the same as is being installed by the Cramp Company in the American-Hawaiian Steamship Company's motorships *California* and *Missourian.*

The main engines are six-cylinder, having a diameter of 29⅛ inches by 45¼ inches stroke, and originally designed for 4,500 indicated horsepower for the two engines, when turning at 115 revolutions per minute. Due to the full form of the *William Penn* the power was reduced by reducing the revolutions to 108, corresponding to the power of 4,200 indicated horsepower required for the 11.5 knots, and thus keeping the mean indicated pressure up to the same as originally designed.

There are, in addition, three auxiliary Diesel engines, each direct coupled to 65 kilowatt generators, for supplying current to the various electric driven engine room and deck machinery. At sea, one of the auxiliary engines was all that was required, with about a 55 kilowatt load carried, which included that required for coffee urns, electric hot plate, etc.

Starts Voyage Around the World

The *William Penn* left New York on September 3, 1921, stopping at Savannah to complete loading. The loading at New York consisted of case oil and barrelled grease, taken on at the Tidewater Oil Company's pier, and miscellaneous cargo put aboard at the pier of the Barber Steamship Lines, in Brooklyn. In Savannah, cotton and barrelled resin were loaded, the latter being placed on deck. She then sailed to the Far East, via Panama and Honolulu, at which latter place about 200 tons more fuel oil was put on to fill the tanks, so that it would not be necessary to purchase any additional oil at the higher prices prevailing in foreign ports.

The first stop to discharge cargo was at Yokohama, and the first severe storm was encountered between the 180 degree meridian and Yokohama, when it was necessary to slow down to prevent losing the deck cargo.

The vessel then proceeded in succession to Kobe, Shanghai, Foochow, Swatow, Hong Kong and Manila. At the latter named place unloading was completed and loading commenced for the return voyage. The next stop was at Cebu, Philippine Islands, and then passing between Celebes and Borneo, she stopped at Surabaya, Java, where Christmas was spent, 8 degrees below the equator. The next port was Singapore, Straits Settlements, where loading was completed for the return trip. The next stop was at Suez. After passing through the Suez Canal, she arrived at Port Said, where a small amount of cargo was taken out. The remainder of the cargo was discharged in turn at Marseilles, London, Rotterdam and Liverpool. From the latter place the vessel sailed on March 6 for New York, in ballast, arriving on the afternoon of the 19th, after having experienced some very severe gales in the North Atlantic, the wind at times attaining a velocity of 110 miles per hour.

On the return trip the vessel was not fully loaded, although the cargo was of very bulky nature, consisting of hemp, copra, rattans, tapioca, coffee, etc.

The total time required for the voyage, counting 24 hours to the day, was 197 days. The total number of days in port was 86, and the total time at sea was 108 days. About 3 days were taken up in passing through the two canals at reduced speed, up rivers, etc., from pilot boats to piers, and standbys at pilot boats, etc.

Fuel Consumption

The mean sea speed from New York to London was 11.01 knots, with a mean consumption of 13.06 tons per diem, (exclusive of donkey boiler). From Liverpool to New York, in ballast, the speed was reduced, due to the ship being in light condition, and to the very severe storms encountered, as previously mentioned, the vessel averaging 8.9 knots, with a mean consumption of 13.15 tons, (exclusive of donkey boiler).

The best speed was made the last day of her voyage, with 12.8 knots, and the main engines developing 4,700 indicated horsepower, thus proving that Diesel engines do not fall off in power at the finish of a long run, as is usual with the steam plant. Compression cards were taken at this time, which showed that compression was normal in all cylinders.

The longest non-stop run was from Singapore to Suez, or 4,943 nautical miles, taking nearly eighteen days, with a mean sea speed of 11.48 knots, and mean total consumption of main and auxiliary engines of 13.41 tons per day. The consumption per indicated horsepower, main engines only, and all purposes, was 0.3025 pound. The mean indicated horsepower taken when leaving Singapore was 4,130 and revolutions per minute 107.9, on a draft of 21 feet 8 inches.

On leaving Savannah the draft was 26 feet 5 inches and the mean sea speed from Savannah to Panama was 11.6 knots, with a consumption per 24 hours of 13.81 tons, and a consumption per indicated horsepower, main engines, all purposes, of 0.3055 pound.

Consumption for Auxiliaries

In port, when loading or unloading, with two or three auxiliary engines in operation during the day, and one engine running for the 24 hours, the consumption for the auxiliary engines was about 150 gallons per day, or 0.48 ton, which is from one-tenth to one-twentieth that for an equivalent steamer. When one engine was operated for the 24 hours, without winches in operation (as over holidays), the consumption was about 110 gallons per day. The consumption of the one auxiliary engine at sea was 120 gallons, or 0.36 ton. The donkey boiler takes from 160 to 170 gallons per day, or 0.52 to 0.55 ton, when in use.

The total consumption for the voyage was 1,475 tons. It is estimated for a steamer the consumption would have been 4,800 tons for the same trip, and it would have been necessary to have purchased 3,000 tons of oil abroad. It is figured that the motorship saved in cost of fuel alone from $60,000 to $70,000. On the outward voyage the deep tank was available for cargo, giving about 5 percent greater carrying capacity than that of the equivalent sister ships. The lowest fuel consumption recorded was from Honolulu to Yokohama, with 0.29 pound of oil per indicated horsepower, main engines, all purposes.

The lubricating oil required when at sea, for the whole plant, including main engines and auxiliary engines, averaged 15 gallons per day, for the voyage.

Considerable bad weather was encountered during the voyage, due to the time of the year. In addition to the storm in the Northern Pacific, after passing the 180th meridian, the *Penn* passed through a typhoon on the way from Hong Kong to Manila, and met very heavy weather and head winds for four days from Port Said to Marseilles. Of the total of 108 days at sea, 24 were stormy.

The *William Penn* sailed on April 22 for the Far East again, carrying chiefly heavy or deadweight cargo, consisting mostly of structural steel, and with the vessel loaded down to the full draft marks. She is able to carry with this class of cargo about 1,000 tons more than an equivalent steamer, representing the additional fuel and fresh water necessary to be carried by the steamer. Accordingly a much better showing should be made over the equivalent steamer on the second voyage.

Several Sister Steamships Laid Up

There are several sister ships equipped with either steam turbines or reciprocating engines, but which have been laid up for the past year or more, due to their inability to run at a profit.

A comparison with the electric driven ship *Eclipse* is in order, but due to incomplete data available for the electrically operated ship a strict comparison is impracticable. The *Eclipse* from various voyages is reported to burn from 32 to 40 tons per day from bar to bar, depending on whether 19 or 24 nozzles on the turbines are open, and corresponding to speeds from about 9 to 10 knots. This works out at about 14.9 tons per 100 miles. The consumption per 100 miles for the motorship *William Penn* from bar to bar works out at 4.87 tons from Singapore to Suez, and 4.94 tons from New York to London. The *William Penn* burns only a small fraction of that of the *Eclipse* in port but which does not appear in the above comparison.

	M/S Wm. Penn	S/S Eclipse
Length between perpendiculars, feet	445	440
Beam, feet	60	56
Depth to shelter deck, feet	36.67	38
Draft, loaded, feet	28.39	28.58
Displacement, loaded, tons	17,100	15,700
Deadweight, tons	12,375	11,867
Cargo, cubic feet, grain	627,830	589,355
Cargo, cubic feet, bales	593,910	552,969
Designed speed, knots	11.5	11
Designed revolutions per minute	108	100
Designed power	4,200IHP	3,000SHP

It will be seen from the above that the hull conditions are much more favorable for the *Eclipse* than for the *William Penn,* due to smaller displacement and finer lines of the former. The *William Penn* is being operated very close to her limiting speed, while the *Eclipse* is considerably under hers. With the *William Penn's* engines in the *Eclipse's* hull a better showing would have been made for the motorship.

Although America has been backward compared with other countries, in adopting the large motorship for the deep sea trade, it is hoped that the *William Penn* has showed the way and that there will soon be laid down a large number of motorships, which are so vital in the maintaining of the American flag on the sea.

The American-Hawaiian Company will soon have in commission two vessels of similar size to the *William Penn,* namely, the motorships *Californian* and *Missourian.* Due to their finer lines they should make a half knot better speed than the *William Penn* with their main engines developing their normal rated indicated horsepower of 4,500.

Differential Between American and British Ships.—A ship of the *George Washington* type would cost in the United States about $9,500,000. She could be built in England for about $7,500,000 to $8,000,000. The American owner of an American built *George Washington* would therefore have to carry, during the life of the ship, an excess capital cost of $1,500,000 to $2,000,000 on which he would be paying probably $250,000 to $300,000 per year more than a British owner of a similar ship. The payroll of this ship would be not less than $450,000 per year, and would involve a wage differential of nearly $100,000. The higher cost of repairs and of the American administrative staff would add to this another $25,000 making a total annual differential against this ship of approximately $400,000.

Electric Auxiliaries on Merchant Ships*

Motors for Deck and Engine Room Auxiliaries — Direct vs. Alternating Current—Wiring and Installation—Operation

By Edgar D. Dickinson†

BECAUSE electricity makes possible many reductions in the cost of operation and at the same time enhances the earning power of a ship, it is being used to an ever-increasing extent for driving the machinery on ships. On highly efficient new ships, especially motorships, practically all the auxiliaries are driven by electric motors. In the motorship Diesel engines are employed to drive the generators. On a steamship, however, the most generally accepted practice is to install turbine-driven generator sets for auxiliary power.

Auxiliary machinery on ships can be readily subdivided into two broad types: (*a*) For deck use; (*b*) for below-deck use. The motors most suitable are enclosed, weather-proof for above deck, and ventilated for below deck.

Deck Machinery

Electric deck machinery has been developed along two fundamentally distinct lines: one in which the motor is mechanically geared to the drums, and the other where some form of hydraulic speed reducing gear is fitted between motor and drum. The latter class seems to have found considerable favor abroad, where certain well-known manufacturers have developed winches, using either the Williams-Jenney or Hele-Shaw hydraulic power transmission. Electric hydraulic power transmission is particularly well adapted for steering gear work and has been developed in this country. For general winch service the hydraulic pump and motor are excessively costly.

For gear winches the series motor or compound-wound with very small amount of shunt winding is the most desirable.

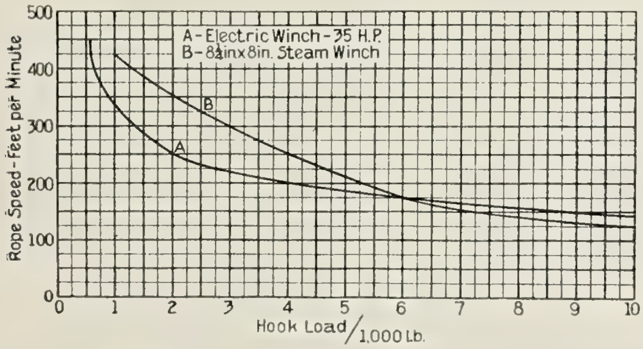


Fig. 1.—Characteristic Curves of Electric and Steam Winches

Fig. 1 shows how the natural characteristics of the series motor make it most suitable for winch service. It is found necessary to throttle the steam winch at light loads to reduce the speed. In practice, therefore, it approaches more nearly the speed of the electric winch. Many winches are fitted with winch heads. When handling cargo with these instead of the drum the revolutions per minute will run up somewhat. However, the winch head being of smaller diameter than the drum, it is generally found that the rope speed on the winch head will be about right.

For all service using hydraulic gear, constant-speed motors are used, either alternating-current or direct-current.

Of all the electric apparatus aboard a ship the winch is subject to the most abuse. Everything about it, therefore, should be designed, manufactured and installed in the most substantial and workmanlike manner.

Specifications for Electric Deck Machinery

Specifications for electric deck machinery should cover the following:

1. Insulation should be as highly moisture-resisting as it is possible to get by the use and treatment of the best materials. This applies not only to windings but to all bushings, brush holder collars, etc., which, if hygroscopic, are liable to result in grounds.

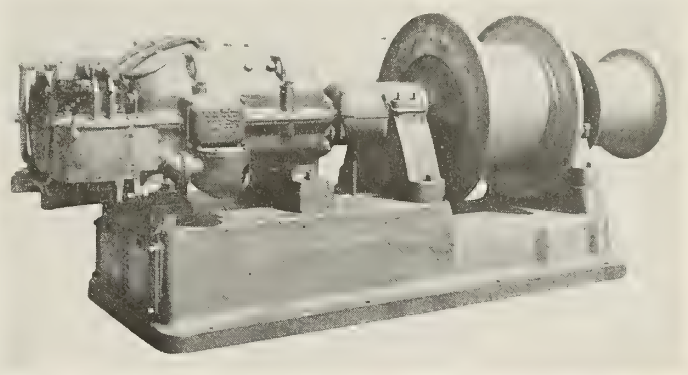


Fig. 2.—New Type of Electric Cargo Winch Having the Reduction Gear Inside the Drum

2. Motor frames should be thoroughly cleaned and painted on the inside to prevent, as far as possible, scale forming by corrosion.
3. Covers for inspection openings should preferably be hinged and arranged so as to clamp tightly. On all apparatus, motors, resistor boxes, controllers, etc., if impracticable to hinge the covers they should be attached by swinging bolts. Cap screws or cap bolts should not be used, as they are liable to be dropped into the motor or left on deck and lost.
4. Bearings should be designed to prevent, as far as possible, ingress of water and egress of oil due to rolling of the ship.
5. All apparatus should be provided with some form of drain. It must be recognized that, while machinery may be built in the factory so watertight that it can be submerged, there is no assurance that this condition will exist after it has been once opened on deck. Further, any totally enclosed electrical apparatus is liable to breathe under varying temperatures which may result in an accumulation of moisture by condensation.

The cost of good electrically fitted machinery installed should be little, if any, more than that of high-grade steam machinery. The insulation in a marine motor must be moisture resisting to the maximum practical extent; otherwise, it should not be deemed proper for the service.

Fig. 2 shows a deck winch developed in this country, several of which type will shortly be installed on ships. This winch is a radical departure from the generally recognized designs using either spur or worm gearing.

Electric steering gears have been developed for mechanical

*Paper read before the Society of Naval Architects and Marine Engineers, New York, November 17, 1921.
†General Electric Company, Schenectady, N. Y.

control of the rudder. For these the service is extremely intermittent, operating from two to ten times per minute, which means that the motor would be started, stopped and reversed thousands of times during one voyage. Such gears require the installation of a motor of sufficient torque to swing the rudder to the extreme angle, whereas during most of the time a very small amount of power is required. This means loss in efficiency as the motor is operating nearly all the time very much underloaded.

For controlling the steering gear from the pilot house two electrical means are available—follow-up and nonfollow-up. The first entails considerably more wiring, a multiple switch in the wheel house, a more complicated control in the steering engine compartment, and has the disadvantage of moving the rudder step by step a definite number of degrees. By the nonfollow-up means the rudder can be moved by fractions of degrees in either direction; its use, however, calls for the installation of a rudder indicator in the wheel house. A device has been worked out to show positively the position of the rudder at any instant, using simple means already developed.

Special Deck Machinery

The following is a table of deck machinery which, with slight modification, would be applicable to ships of any tonnage between 8,000 and 10,000 tons deadweight. It should be borne in mind that the size of the cargo winches is based upon the best practice for general cargo and therefore does not vary greatly with the size of the ship. The number of winches, however, has to be modified to suit the number of hatches and derrick booms of the different ships.

	No. units	Assumed motor horsepower	Duty
Anchor windlass..	1	70	Very intermittent, severe. Often submerged. May be stalled in operation.
Cargo winches....	12	35	Intermittent. Fast cycle, severe duty. Sometimes submerged. Wide range in loads and speeds.
Steering gear.....	1	35	Seldom fully loaded. Severe intermittent duty with mechanical gear. Moderate continuous duty with hydraulic gear.

Types Developed (Electric Deck Machinery)

	Drive	Motor	Speed control
Anchor windlass and capstan....	Spur gear....	Reversing	Electric.
	Worm gear...	Reversing	Electric.
	Hydraulic ...	Constant speed.	Hydraulic.
Cargo winch...	Worm gear. Spur gear..	Reversing	Electric with electric brake (general use).
		Reversing	Electric with mechanical brake.
		Constant speed.	Mechanical brake and clutch (free drum winch).
		Constant speed.	Mechanical brake hoisting and lowering clutches.
		Constant speed.	Reverse gear and brake. No speed control (winch head only).
	Hydraulic ...	Constant speed.	Hydraulic.
Steering gear.....	Spur gear....	Reversing	Electric.
	Worm gear...	Reversing	Remote.
	Hydraulic ...	Constant speed.	Hydraulic.

Below-Deck Machinery

It should not be necessary to emphasize the importance of fitting equipment of proper design and of the highest grade material, particularly pumps vital to the operation of the ship and which must be relied upon to operate continuously day and night for weeks at a stretch.

The greater part of the electrical machinery below deck is naturally located in the engineroom. The following table gives a list of below-deck auxiliaries suitable for a cargo ship of about 8,000 to 10,000 deadweight tons and equipped with 2,500 to 3,000 shaft horsepower steam turbine. A motorship requires somewhat fewer auxiliaries, and slightly less power is necessary for driving them. Tankers require a number of motor-driven pumps for discharging the cargo. These may be installed either in a special pump room or arranged with the motors on deck with vertical shafts to the pumps below. It will be noted that in the list there are only five sizes of motors. That is with the intent of simplification and to reduce the number of spare parts to be carried. A study of particular cases may show that it is possible to satisfactorily arrange the engine-room equipment so as to have still fewer sizes.

Below-Deck Auxiliaries

	No. units	Assumed motor rating in horsepower	Duty
Propulsion:			
1. Circulating pump	1	40	Continuous at sea.
2. Boiler feed......	2	25	One continuous at sea.
3. Forced draft fan.	1	20	Continuous at sea.
4. Condensate	1	5	Continuous at sea.
5. Lubricating oil...	2	5	One continuous at sea.
6. Oil cooler water..	1	5	Continuous at sea.
7. Fuel oil.........	2	5	One continuous at sea.
8. Fuel oil trans....	1	5	Intermittent (assume 4 hours per day).
Service:			
9. Fire and bilge...	1	10	Intermittent (assume 6 hours per day).
10. General service..	1	10	Intermittent (assume 6 hours per day).
11. Sanitary	1	5	Intermittent (assume 12 hours per day).
12. Fresh water.....	1	5	Intermittent (assume 2 hours per day).
13. Refrigerating ...	2	5	One continuous at sea.
14. Evaporator	1	5	Intermittent (assume 3 hours per day).
15. Ballast	1	10	Intermittent (assume 4 hours per day).
16. Workshop	1	5	
17. Oil purifier......	1	5	
18. Galley	1	5	

Motors for these auxiliaries should be designed for continuous running, because, while certain pumps may be started and stopped frequently, the service cannot be considered intermittent.

In the engine room, and in fact even if placed in the lowest part of the ship, totally enclosed motors are not recommended. For continuous operation they would have to be excessively large. With the changes in the atmosphere that take place below the waterline, enclosed motors would be more liable to sweat and accumulate moisture internally than if well ventilated. In general, enclosed self-ventilated motors are recommended for the reason that they are often located in congested places where, if open, they would be

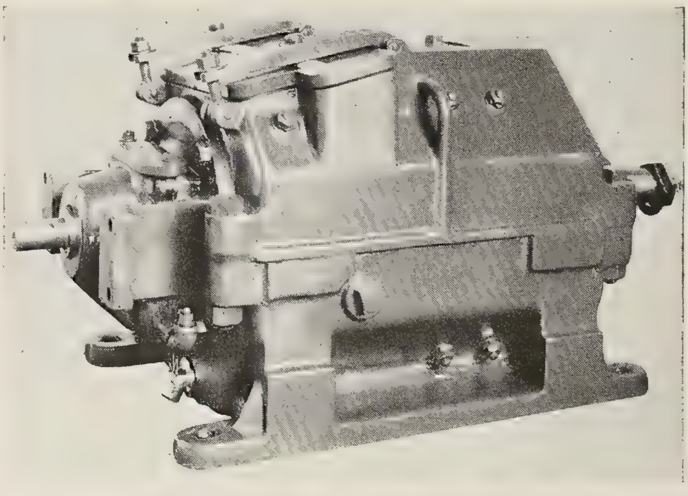


Fig. 3.—Direct Current Motor, Enclosed for Operating Deck Machinery

liable to mechanical injury and in addition would have to be protected from dripping water. However, as electrical machinery, when open, is more readily inspected and kept clean, it is not essential that the motors be enclosed if located, *e. g.*, on a gallery and properly protected from dripping water. Such motors should be screened to prevent rats eating the insulation. On tankers, if the cargo pump motors are of the direct current type and are located in a special pump room, they must be provided with some means of ventilation which will insure all explosive gases being driven off before the motors are started.

The motors in the engine room should be insulated with the same care and the castings as thoroughly cleaned and painted as the motors on deck. The insulation on all marine electrical apparatus should be made as highly moisture-resisting as possible.

As illustrating the adaptability of electrical apparatus, the writer recently saw a report from a chief engineer which stated that when the steam engines on his circulating pump and dry vacuum pump broke down he replaced them by two deck winch motors. The drive was so satisfactory that he intended to recommend that it be made permanent, and incidentally the ship burned 1½ tons of fuel oil per day less after the change.

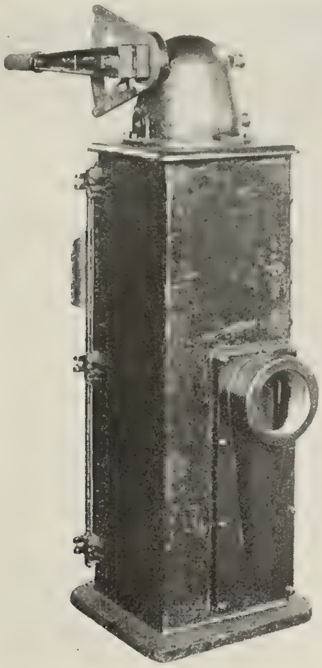


Fig. 4.—Controller for Deck Machinery Motors

Control

It would seem desirable that the means for starting and stopping each motor be located directly adjacent to it. Such starters are relatively inexpensive. They should be very substantial and moisture-resisting. Thin sheet iron should not be used, especially on any part of the construction which cannot be readily painted, as after a short time it is liable to rust and may be the cause of serious trouble.

On steamships the motors on the circulating pump, lubricating oil pump, boiler feed pump, hot well pump, balancer set or lighting motor-generator set, if any, and steering gear, should be fitted with starters, so that when power is restored after an interruption these particular motors will immediately start up automatically. The other motors can be restarted by the engineer at his convenience.

Generating Units

A study of the installations on a number of cargo ships of various tonnages indicates that on a steamship 150 kilowatts would give ample power for the deck machinery when in port and for the entire engine-room equipment when at sea. On a motorship about 75 kilowatts are necessary at sea. Therefore, on cargo ships of about 10,000 deadweight tons, two 150 kilowatt steam turbines or on the motorships three 75 kilowatt generator sets would give ample power with one unit for a standby at all times. The auxiliary power in many cases will be much greater than 150 kilowatts on refrigerator ships and on ships fitted in part for passenger service. The larger the amount of auxiliary power the greater the reason for highly efficient auxiliary turbines. Some studies have shown requirements for auxiliary power as great as 1,500 kilowatts.

Small steam turbines should be rugged and simple, as they will be classed as part of the propelling machinery and therefore vital to the safety of a ship. In sizes of 150 kilowatts and even smaller, gear reduction would be recommended, as the best direct current generator operation cannot be expected at the speed at which the turbine should run in order to get good economy. It is expected that these sets will be more substantial and rugged than sets of similar capacity for land service, where they are at all times readily accessible.

For the reason that on shipboard there is always possibility of scale or salt passing to the turbine from the boilers, it is preferable for the governor to control the speed by means of an oil Servo motor. All parts should be readily accessible. Even with the greatest care there is always liability that the lubrication may be momentarily interrupted, and as the bearings should be examined before the machinery is placed in service they should all be readily removable for inspection. An overspeed or emergency governor of the simplest and most reliable type should be fitted. Very specific and simple instructions should be issued to show the operating engineer the necessity of testing the governing mechanism periodically and assuring himself that it is in perfect operating condition.

The Most Suitable Electric Power

All references indicate that at the present time direct current is being generally adopted for auxiliary power on merchant ships. Some time ago there was considerable discussion as to the relative merits of alternating current and direct current. The following tabulation will show why direct current is being used to the greater extent:

Cargo Ships

Arguments For	*Arguments Against*
Direct Current	
1. Simple wiring.	1. Commutators require some attention.
2. Any speed control easily obtained.	
3. Equally suitable for continuous and intermittent duty.	
Alternating Current	
1. Lower cost of motors and generators.	1. Wiring more expensive
2. Absence of commutators.	2. Unsuitable for variable speeds necessitating hydraulic or other gear for winches and windlasses.

Tankers

Direct Current	
1. Simple wiring.	1. Commutators require some attention.
2. Equally suitable for continuous and intermittent duty.	2. Little necessity for variable speed motors. Special cases could be fitted with hydraulic or direct-current power furnished from small motor-generator set.
3. Speed of cargo pump can be varied to suit pressures and most efficient rate.	3. Special precautions must be taken to ventilate motors in tank room.
Alternating Current	
1. Lower cost of motors and generators.	1. Wiring more expensive.
2. Absence of commutators, particularly desirable in pump room.	2. Special motors necessary to change speed.
3. Cargo handled by constant speed pumps.	

It would seem that for cargo ships direct current can be used to the greatest advantage. On tankers this is not so apparent.

Except in the smaller ships, it is desirable to use not less than 230 volts. The lower voltage necessitates large or more expensive control; also the cost of wiring and switches is greater.

For lighting, the arguments seem to be in favor of 115 volts. This necessitates the installation of a small 115/230-volt motor-generator set. The use of incandescent lamps for 230 volts is not recommended.

Wiring and Installation

It is impossible to speak too forcibly on this subject. A

great deal of the criticism of electrical apparatus when thoroughly investigated has been found to be directly due to faulty, careless, slipshod methods of wiring and installation. Care and attention have been given to choosing apparatus, but the method of installation, the kind of wire, and many details of vital importance have been left to the wiremen's discretion with the inevitable result.

It is not the intention here to suggest that definite rules be laid down. Each engineer must work out his own particular problems. Certain underlying fundamentals, however, can generally be applied. The following are recommended:

That the wiring and distribution in the engine room be made as simple as possible, with relatively few circuits.

The switchboard should be largely a distribution panel designed with the idea of attaining maximum simplicity and occupying the least amount of engine-room space.

Circuits may be led from this distribution panel to different parts of the ship where they may be further subdivided,

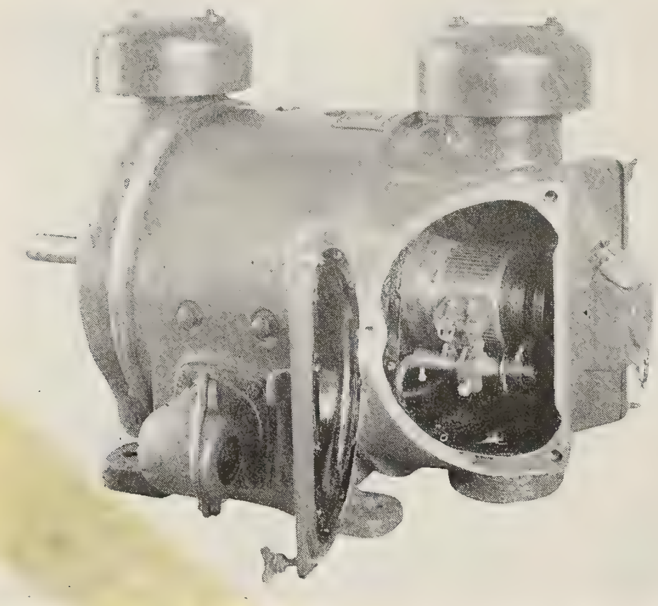


Fig. 5.—Direct Current Motor, Enclosed, Ventilated for Operating Below-Deck Machinery

as *e. g.*, five circuits for deck machinery, No. 1 to the steering engine, No. 2 to the after hatches, No. 3 to the forward hatches, No. 4 to anchor windlasses and forward capstans. No. 5 to after capstans. This will permit opening all the winch circuits when at sea and also allow for thorough inspection and try-out of the capstans, anchor windlass or steering engine when in port, even if cargo is being handled.

In the engine room a similar method may be applied, one circuit to the engine-room auxiliaries, port side, and another to the starboard side. By such simplification it will be possible to obtain low cost with maximum reliability.

Cables should not be run in conduits except, perhaps, for very short lengths where necessary for mechanical protection. Cables in the engine room should be run overhead. All cables should be thoroughly anchored so that the covering will not be chafed, due to vibration.

Operation

To study the relative merits of ships' auxiliaries, it is necessary to consider the part which they play in the economic operation of the ship.

It is not possible to make any exact general statement as to the proportions of the various items constituting the cost of operating merchant ships. They may, however, be listed as follows:

1. Fuel and lubricating oil at sea and in port.
2. Port charges including wharfage, lighterage, pilot fees, canal dues, stevedoring, tugboat charges, etc.
3. Salaries and subsistence.
4. Upkeep and repairs, deck department.
5. Upkeep and repairs, engine department.
6. Supplies, engine, deck and steward's departments.
7. Insurance
8. Loss and damage.

If we assume a 7,800 deadweight-ton ship fitted with 2,500 horsepower steam turbine on a schedule for coastwise service between New York and Seattle, stopping at San Pedro to load and discharge cargo and making four round trips per year, the charges might be approximately as follows:

Operating Disbursements

	Loaded both ways	Percentage	Loaded going, one-half loaded returning
1. Fuel	\$81,300	14.8	\$81,300
2. Port charge	290,420	52.9	211,020
3. Salaries	60,490	11.0	60,490
4. Repairs, deck	10,000	1.8	10,000
5. Repairs, engine	20,000	3.7	20,000
6. Supplies	20,250	3.7	20,250
7. Insurance	62,400	11.4	62,400
8. Loss and damage	3,650	.7	3,650
Total	\$548,510	100	\$469,110

Many of these would be affected by electrification of auxiliaries, and the net reduction would be very considerable.

1. *Fuel, etc.*—In the usual marine geared turbine installation with steam auxiliaries, the pressures generally carried are as follows:

	Gage
Boiler pressure	210 pounds.
Turbine bowl	200 pounds.
Auxiliary steam line	100 pounds.
Auxiliary exhaust	10 pounds.
Superheat	75 degrees F.

The auxiliary exhaust steam is used to heat the feed water, and that which is in excess of feed water heater requirements is by-passed to the main condenser.

Under full power, a fair operating average for this type of installation is as follows:

Steam Consumption per Hour:

	Pounds
Main turbine, 2,500 horsepower	28,875
Steam auxiliaries at sea	12,500
Total steam consumption	41,375

Steam per Shaft Horsepower Hour, all Purposes

$$\frac{41,375}{2,500} = 16.5 \text{ pounds.}$$

Boiler Evaporation.—With watertube boilers, Howden draft system, feed water delivered to boilers at 220 degrees, 210 pounds gage pressure and 75 degrees superheat, a conservative estimate of the actual evaporation per pound of fuel oil is taken at 13.5 pounds.

Fuel Consumption:

$$\text{Fuel per hour} = \frac{41,375}{13.5} = 3,065 \text{ pounds} = 9.6 \text{ barrels.}$$

Fuel per day, 73,560 pounds = 32.8 tons

Fuel in barrels per day 230

Fuel per Shaft Horsepower Hour:

$$\frac{3,065}{2,500} = 1.23 \text{ pounds.}$$

Fuel in Barrels, per Knot:

$$\text{Assuming a speed of 10.5 knots, } \frac{9.6}{10.5} = 0.915 \text{ barrel per knot.}$$

The economy to be gained through the application of electrically driven auxiliary machinery, in fuel consumption alone, may readily be seen from the following estimates:

Electric Auxiliaries

Superheat, 75 Degrees F.

Heating Feed Water.—The proposed method would be to extract sufficient steam from the turbine for feed-water heater requirements.

Steam Consumption, per Hour:

	Pounds
Main turbine, 2,500 horsepower	30,600
Turbine generator	2,640
Air ejector	1,000
Total	34,240

Note—3,600 pounds per hour steam will be extracted from main turbine at about 10 pounds gage to heat feed water.

Steam per Shaft Horsepower Hour, all Purposes:

$$\frac{34{,}240}{2{,}500} = 13.7 \text{ pounds}$$

Boiler Evaporation.—Estimated for comparative purposes at 13.5 pounds per pound of fuel. With the lesser quantity of steam to generate, however, the boiler efficiency would be improved in actual practice.

Fuel Consumption:

Fuel per hour, $\frac{34{,}240}{13.5} = 2{,}536$ pounds $= 7.9$ barrels.

Fuel per day, 60,864 pounds = 27 tons.
Fuel per day, in barrels = 189 barrels.

Fuel per Shaft Horsepower Hour:

$$\frac{2{,}536}{2{,}500} = 1.01 \text{ pounds.}$$

Fuel in Barrels per Knot:

Assuming a speed of 10.5 knots, $\frac{7.9}{10.5} = 0.75$ barrel per knot.

The application of high superheat, well within the limits of present-day design, and electric auxiliaries present a very interesting and high economic value in ship propulsion.

ELECTRICAL AUXILIARIES

Superheat, 200 *Degrees F.*

Steam Consumption, per Hour:

	Pounds
Main turbine, 2,500 horsepower	27,000
Turbine generator	2,400
Air ejector	1,000
	30,400

NOTE—3,000 pounds per hour steam will be extracted from main turbine at about 10 pounds gage to heat feed water.

Steam per Shaft Horsepower Hour, all Purposes:

$$\frac{30{,}400}{2{,}500} = 12.15 \text{ pounds.}$$

Boiler Evaporation.

Assumed at 13 pounds per pound of fuel.

Fuel Consumption:

Fuel per hour $= \frac{30{,}400}{13} = 2{,}340$ pounds $= 7.33$ barrels.

Fuel per day, 56,200 pounds = 25.1 tons.
Fuel in barrels per day = 176 barrels.

Fuel per Shaft Horsepower Hour:

$$\frac{2{,}340}{2{,}500} = 0.936 \text{ pound.}$$

Fuel in Barrels per Knot:

Assuming a speed of 10.5 knots, $\frac{7.33}{10.5} = 0.698$ barrel per knot.

These estimates show the saving in fuel consumption by the use of electric auxiliaries, as follows:

Saving in Fuel Consumption (at sea):

Steam auxiliaries, 230 barrels.
Electric auxiliaries, 189 barrels, 17.3 percent.
Electric auxiliaries, with 200 degrees F., 176 barrels, 23.5 percent.

Saving per Year:

208 days at sea, oil at $1.50 per barrel.
Electric auxiliaries, 8,320 barrels at $1.50 = $12,480.
Electric auxiliaries, with 200 degrees F. superheat, 11,250 barrels at $1.50 = $16,900.

In the estimate, an allowance was made of 40 barrels per day in port. With electric auxiliaries and economic engine-room machinery, it should be possible to reduce this by one-half.

157 days × 20 pounds × $1.50 = $4,710.

With a good system in the engine room, the lubricating oil required would be greatly reduced.

2. *Port Charges.*—In giving thoughtful consideration to improving the earning power of a ship, it will be recognized as essential to decrease its idle time, as certain charges are continuous, whereas the ship is actually earning money only when traveling between ports. When it is realized that the average cargo ship makes only about 36,000 miles per year and that at an average speed of 10 knots, which means that she is at sea only about 150 days out of a year, it is very evident that there is a big field for improvement.

Port charges estimated for the coastwise schedule mentioned above are as follows:

	New York	Colon	Los Angeles	San Francisco	Seattle	Total
(a) Wharfage	$7,800.00	....	$1,560	$3,120	$3,120	$15,600.00
(b) Lighterage	......	....	....	....	....	......
(c) Pilots' fees	202 56	....	200	250	....	652.56
(d) Stevedoring	7,800.00	....	1,560	3,120	3,120	15,600.00
(e) Tugboat charges	100.00	....	....	200	....	300.00
(f) Canal dues	......	$4,150	....	....	....	4,150.00
Total per trip						$36,302.56
Total per year (four round trips)						290,420.48

It will be evident that any means which will reduce the time a ship has to lie at the wharf loading or unloading cargo should lessen the two items, wharfage and stevedoring. The writer has been informed of specific cases where ships have been delayed at docks due to freezing of steam-deck machinery. He has also been informed of a specific case where with two similar ships loading and unloading the same kind of cargo at the same dock and with the same stevedore foreman, the electrically equipped ship loaded in very much less time. Another specific case was where a number of ships fitted with steam-deck machinery had to await the derrick to assist in loading heavy cargo, while a ship fitted with electric machinery was able to handle its own cargo and saved a number of days' delay.

Delays have been experienced with steam machinery due to low steam pressure. This may not be due to drop in boiler pressure but to loss in piping. With electric equipment there is always ample power available for the winches.

By the use of the most suitable electric machinery, it should be possible to reduce the item of port charges 10 percent. In the estimate given above this would mean approximately $30,000 per year saving.

3. *Salaries.*—In all probability the salaries would not be directly affected. In the larger ships and in those where there is a very large amount of auxiliary power it might be found desirable to increase the salary slightly for one of the positions, in order to secure a man with electrical experience.

4 and 5. *Upkeep and Repairs.*—Both of these items should be reduced. With properly designed electric machinery, the charges for repairs and maintenance would be less than with steam machinery. If compared with many existing ships, a 20 percent reduction would in all probability be a conservative estimate. If we only allow 10 percent, however, this would mean a saving of approximately $3,000 per year on the above estimate.

6. *Supplies.*—This item would not be appreciably affected in the deck department, but for the engine department there should be a material reduction. A saving of 10 percent might be expected, which would amount to $2,000 per year.

7. *Insurance.*—The assured reliability of proper electrical machinery in the engine room, along with the elimination of a large amount of piping carrying high pressure steam, should have a direct bearing on the insurance rate. Indirectly, by reducing the loss of steam it should be possible to maintain the water in the boilers in almost perfect condition. This should still further add to the safety of a ship. It would seem to be justifiable to expect that the insurance premiums can be decreased about 5 percent; this would mean a saving of approximately $3,000 per year.

8. *Loss and Damage.*—This item in all probability would not be affected.

The sum of the different gains mentioned above totals $55,190 per year. The amount of saving that can be shown by other estimates will naturally vary with conditions. In any estimates the possibility of making a substantial gain in the earning capacity in a ship is a real one. Having in mind certain ships, there is every reason to believe that the figures mentioned above might be increased.

One of the latest British combined cargo and passenger ships is equipped electrically and is fitted with over 100 motors driving auxiliary apparatus. Needless to say, the owners of new foreign ships are fitting them with electrically driven machinery only because they have satisfied themselves that it is profitable to do so. We engineers in this country should combine our efforts and avail ourselves of every opportunity to improve the efficiency of our merchant ships.

The Influence of Shape of Transverse Sections Upon the Resistance of Vessels of Moderate Speed*

By Professor Herbert C. Sadler† and Professor E. M. Bragg††

FROM time to time results of experiments on the influence of shape of bow and stern sections upon the resistance of ships' forms have been recorded, but usually these have referred to special cases, sometimes accompanied by other changes of form and generally for vessels of somewhat high speed.

Froude's original dictum of U-shaped sections forward and V-shaped aft still lingers in the minds of most designers as applicable to all forms at all speeds. Some years ago some experiments on models of full form were conducted in the experimental tank at the University of Michigan (see Vol. 17, Society of Naval Architects and Marine Engineers), in which it appeared that the V-shaped sections, both forward and aft, gave the better results.

The following investigation was therefore undertaken with the object of covering the field more fully, especially for the slower and moderate speed types.

The parent body plans and curve of sectional areas are shown in Fig. 1, and indicate the changes in type of sections used. They are based upon a vessel 425 feet between perpendiculars by 56 feet, with a normal load draft of 24 feet 9 inches, and a deep load of 27 feet 9 inches. The vessel has a cruiser stern and a length on the deep load line of 435 feet, this length forming the basis that was used for the spacing of sections.

The shape of the cruiser stern had to be modified slightly with different lengths of run for fairing purposes, but at the 24-foot 9-inch draft the change in length was negligible.

The various percentages of ends and middle bodies are given in terms of the length between perpendiculars. All the results have been reduced to a temperature of 65 degrees F.

In general, two parent forms were taken as follows:

1. A model with a fixed length of run and with "medium" type of stern sections.
2. A model with a fixed length of entrance and "medium" type of bow sections.

Each model was further modified in the following manner:

Fixed run 40.5 per cent L. B. P.	Five lengths of entrance from 23.7 percent to 48.5 percent L. B. P.	Each type with U, Medium, and V-shaped sections forward.
Fixed entrance 27 percent L. B. P.	Four lengths of run from 24.3 percent to 48.6 percent L. B. P.	Each type with U, Medium, and V-shaped sections aft.

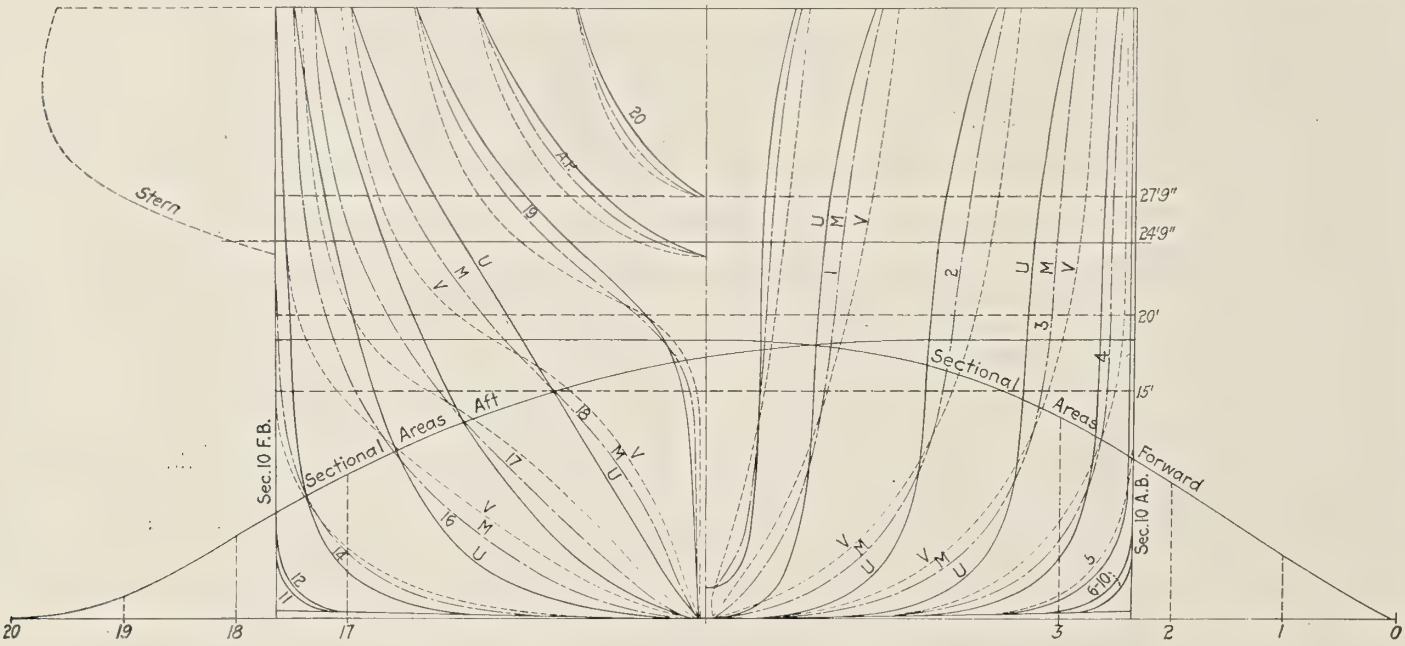


Fig. 1

The parent forms, with the above lengths of entrance and run, were selected from a former series of experiments covering some hundred types and appeared to be those that gave the best results from a resistance standpoint, for the range of speeds suitable for the present series of models. Each model was tested at four different drafts and consequently represents four types of vessels with varying ratios of beam to draft, and varying prismatic coefficients.

The particulars of the parent form are given in the following table, the prismatic coefficients being for the whole vessel, and a parallel middle body of 32.5 percent.

	Bow sections varying	*Stern sections varying*	*B/d*
15-foot draft	U, .734 M, .730 V, .727	.737 .728 .721	3.73
20-foot draft	U, .756 M, .754 V, .753	.757 .753 .750	2.8
24-foot 9-inch draft......	U, .772 M, .772 V, .772	.772 .772 .772	2.26
27-foot 9-inch draft......	U, .785 M, .786 V, .787	.783 .784 .785	2.02

*Paper read before the Society of Naval Architects and Marine Engineers, November, 1921.

†Professor of naval architecture, University of Michigan, Ann Arbor, Mich.
††Professor of naval architecture and marine enginerineg, University of Michigan.

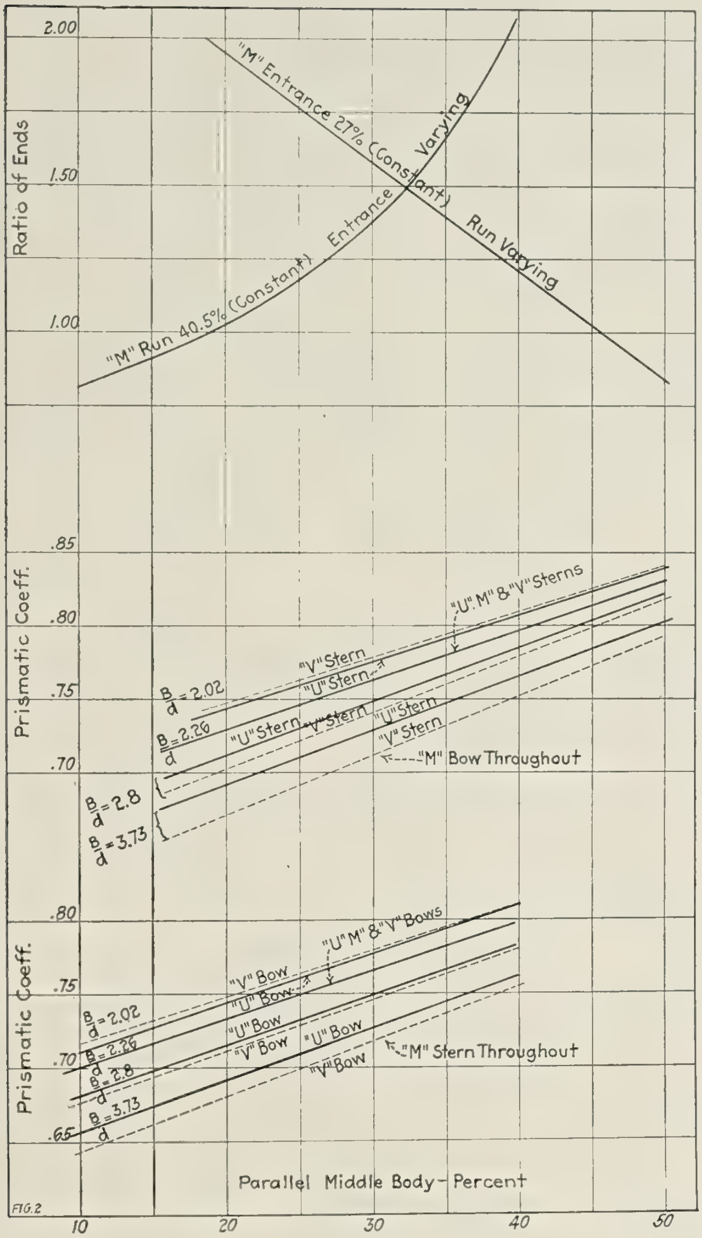


Fig. 2

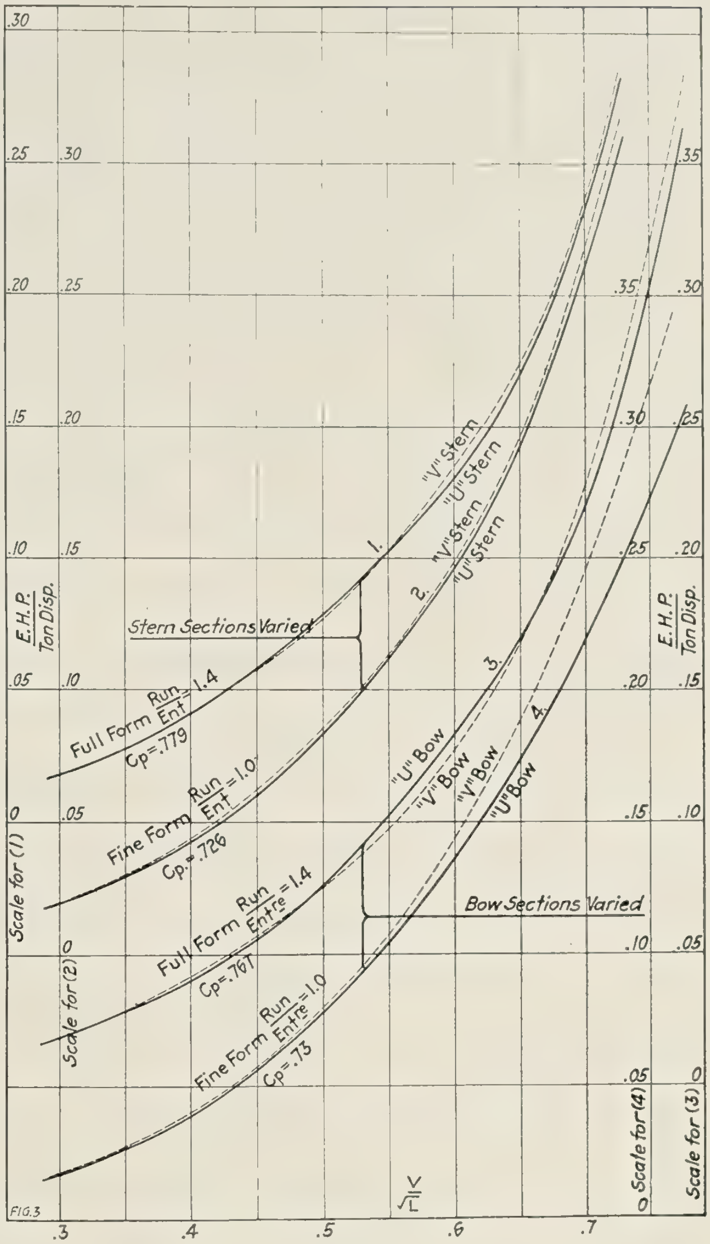


Fig. 3

For other variations of percentage of middle body and ends the change in prismatic coefficient is shown in Fig. 2.

Methods of Plotting Results

There has been some discussion in this and other countries as to the various methods used for recording the results of tank experiments. Here it has been customary to give the residuary resistance in pounds per ton of displacement on a speed-length ratio base. Abroad, the Froude constant system or **C** values, or a modification by Baker, or **P** values have been used. Arguments pro and con for each system can be made, but the deciding factor rests in the use to which the results are to be put. If for general comparative purposes in tank work, then the **C** values on a speed-length ratio base, or even **P** values, possess certain advantages. In other words, the "ideally best" vessel may be readily determined. If, however, the results are to be used by the practicing naval architects, it would seem that a somewhat more simple form would be preferable, especially as limiting conditions of design, and the necessity of arriving at the results of minor modifications quickly are the governing factors.

The following results have therefore been plotted in the form of effective horsepower per ton of displacement or $\frac{\text{EHP}}{\text{Tons}}$ upon a speed-length ratio or $\frac{V}{\sqrt{L}}$ base, and apply directly to a 425-foot ship.

They can be readily modified for any other length by multiplying by the square root of the length ratio up to a difference of 10 percent either way, and within the limits of, say, 2 or 3 percent either way may be taken as practically constant for a given speed-length ratio.

Another reason why there appears to be no particular necessity for having a system which will apply to all lengths of ships from the model up is that in practice the ratio of length to beam, and beam to draft will vary considerably in passing from a small to a large vessel, and therefore the results of any set of experiments must necessarily have a somewhat limited application, depending upon the relative sizes and types of vessels.

The ratio of horsepower to displacement is also one of the factors entering into the economy of vessels and hence in preliminary design work may have to be taken into account.

A discussion of the proposed method is given in the appendix.

In order to exaggerate certain features in the present paper so that the diagrams will show more clearly the effect of the

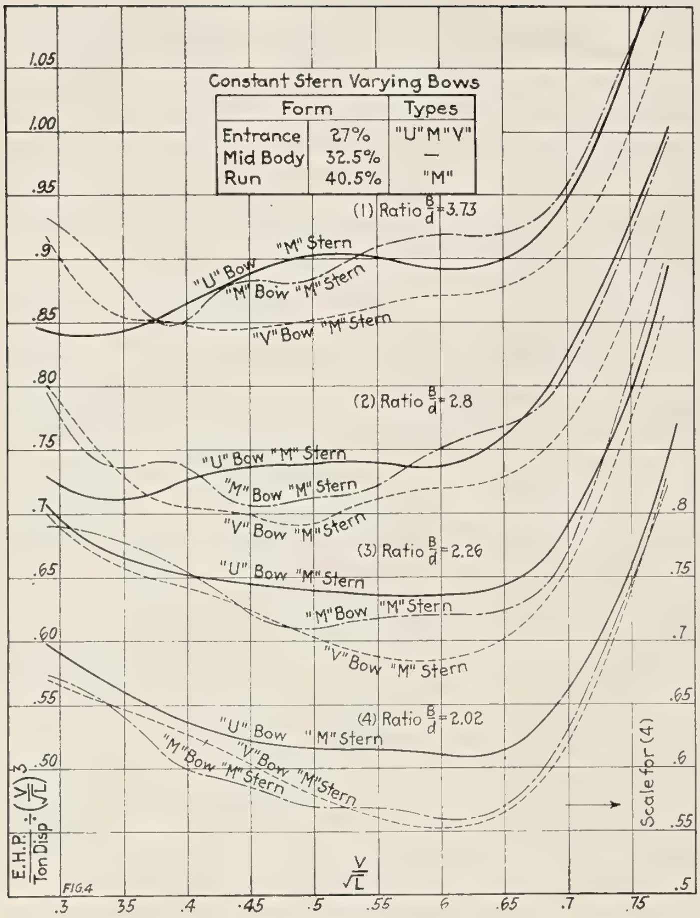


Fig. 4

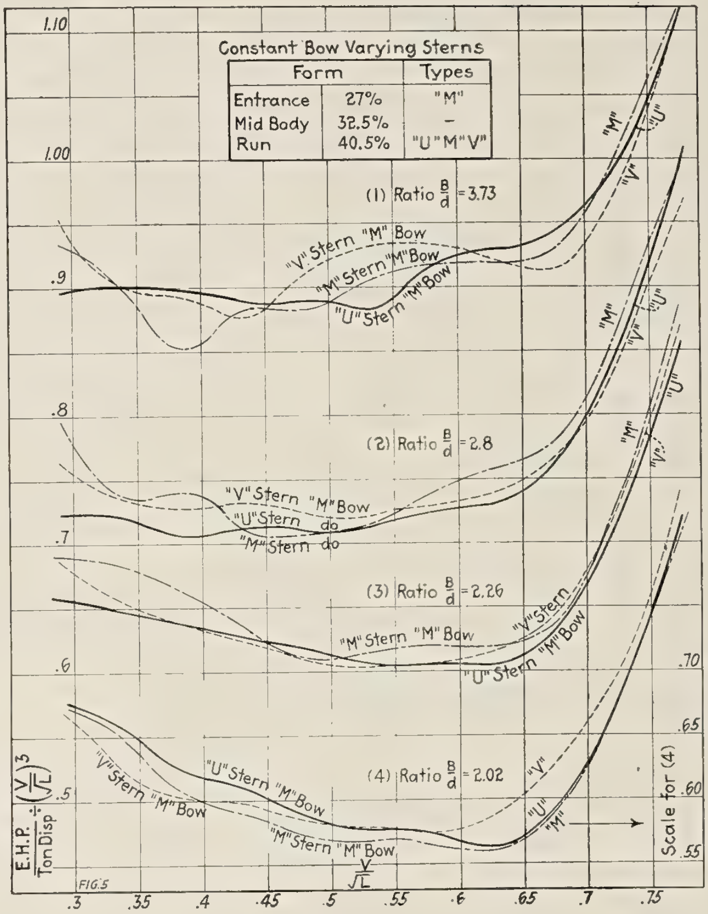


Fig. 5

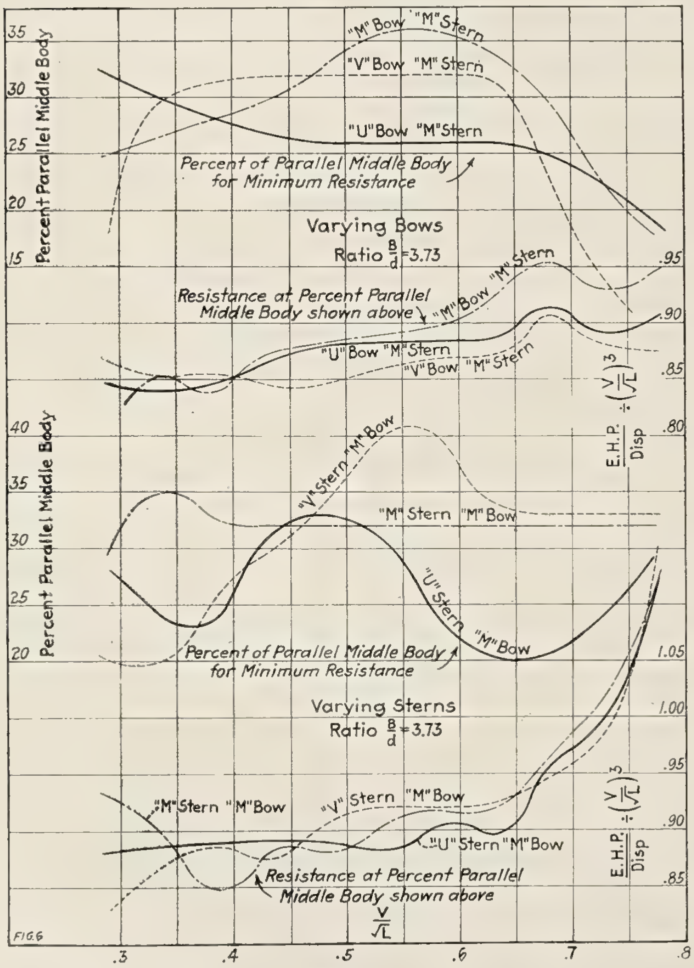


Fig. 6

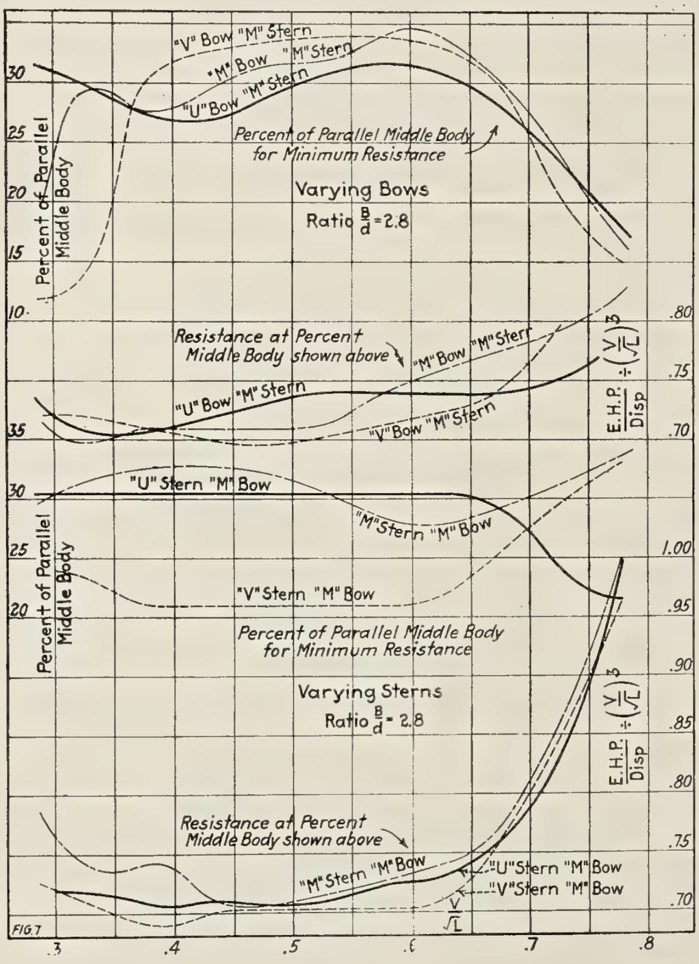


Fig. 7

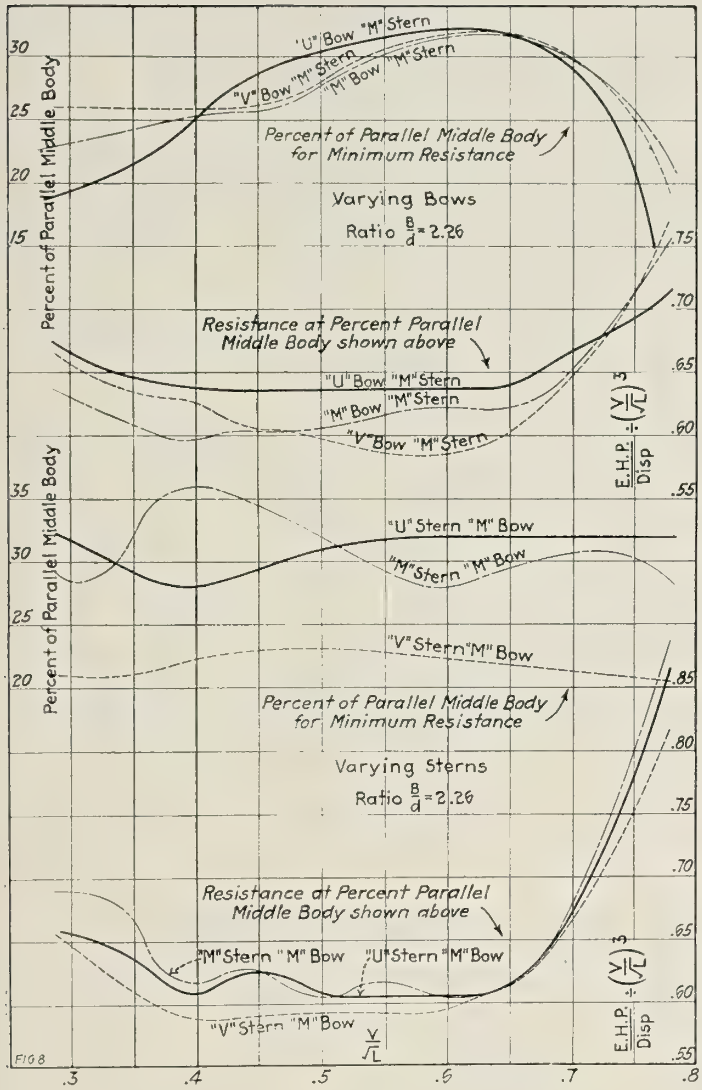


Fig. 8

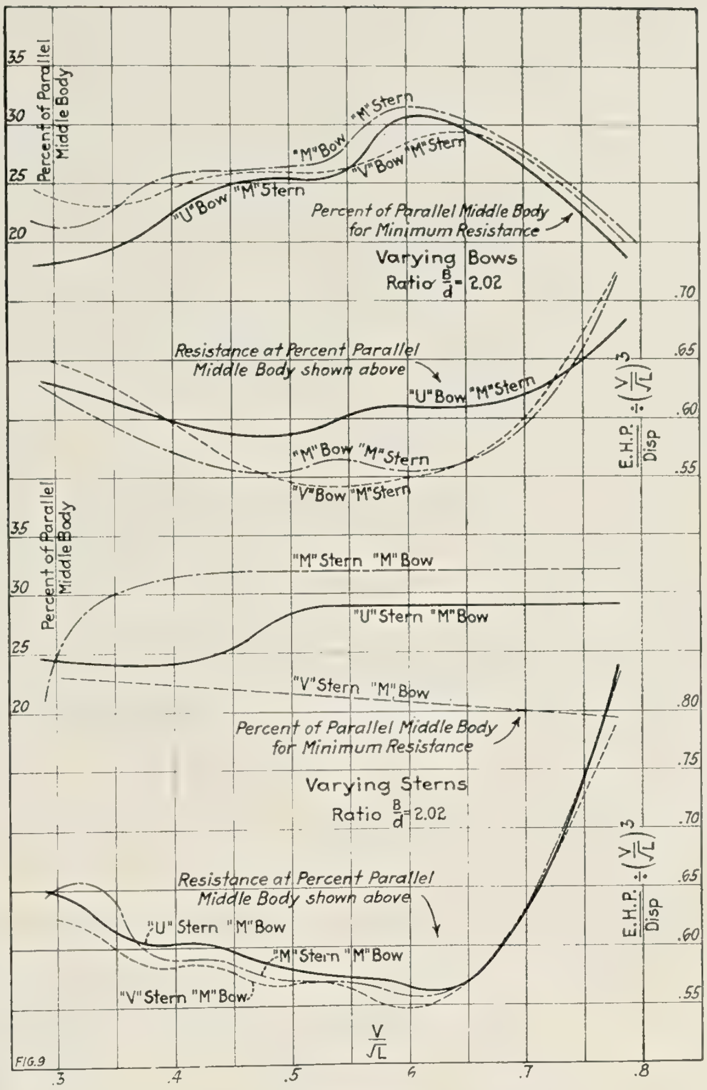


Fig. 9

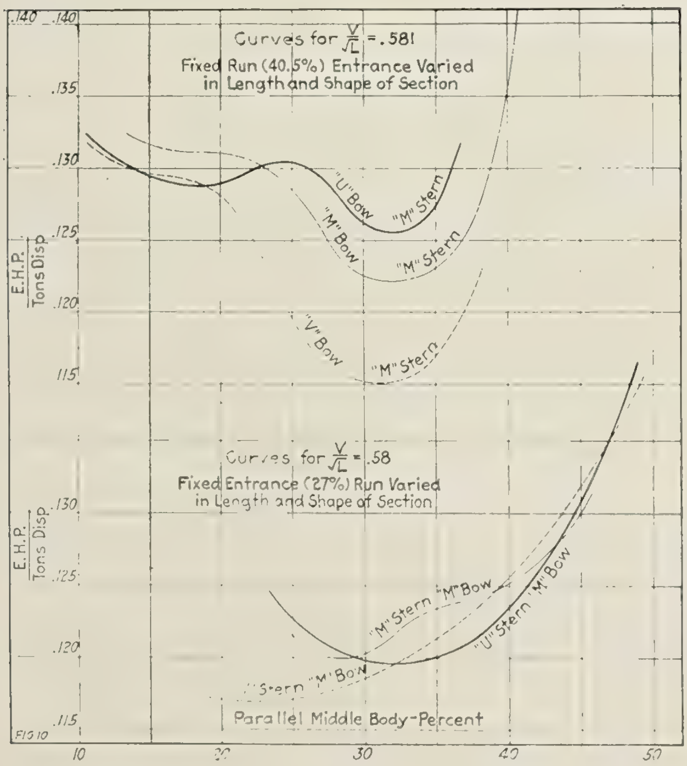


Fig. 10

varying of the shape of section of the vessel and to bring them into the limited dimensions of the volumes of our transactions, some of the figures have been modified by a factor representing the cube of the speed-length ratio.

Results of Experiments

As a general comparison of U- and V-shaped sections Fig. 3 shows the effect upon the resistance for a full and a fine vessel with (*a*) stern sections and (*b*) with bow sections varied. With regard to the influence of bow sections it is apparent that, within the range of speed suitable for the vessel concerned, the V-shaped sections are best for the full form and the U-shaped sections for the fine form.

When the stern sections only are varied, the influence upon resistance is not so marked, but in general the U-shape appears to give the better results. It should be remarked, however, that the so-called U-sections aft are of the moderate type and not so pronounced as the corresponding bow sections.

The diagrams shown in Fig. 4 and Fig. 5 illustrate, for a selected model, the variation of resistance in terms of speed due to modification of bow sections with a constant medium type of stern, and modification of stern sections with constant medium type of bow; and also the influence of change of draft from the light to the deep load.

Figs. 5, 6, 7, 8 and 9 show the percentage of parallel middle body at which the resistance is minimum for any given speed, and the value of the effective horsepower per ton at that speed. They have been obtained from curves sim-

ilar to that shown in Fig. 10, which illustrates the effect of the various changes for a selected speed-length ratio of .581. Each of the above figures refers to a given draft or, for the models concerned, a variation of breadth to draft of from 3.73 to 2.02.

Conclusions

A study of the diagrams will reveal certain facts which are of interest. In the first place, it is evident that no hard and fast rule can be laid down as to the best type of bow and stern sections for all ships at all speeds; and, in the second, that the best type of section for a given ship at the load draft is not necessarily the best for the same ship at lighter drafts. The selection of the best type of section will depend upon:

1. The speed-length ratio.
2. The fullness of the vessel.
3. The distribution of displacement longitudinally.
4. The ratio of breadth to draft.

Certain rather broad conclusions may, however, be drawn In the finer types of vessels of the merchant ship type and at speed-length ratios over .75 and not exceeding, say, 1.0, the U-shaped bow sections accompanied with moderately V-shaped sections aft, *i. e.*, sections not too full on the waterline, will in general give good results.

In the fuller types and at speed-length ratios in the neighborhood of about .6 or under, the V-shaped bow sections, accompanied with moderate stern sections as above, will, in the majority of cases, give a satisfactory form.

If it is anticipated that the vessel is to run at reduced draft for any appreciable percentage of her time, then the U-shaped bow sections lose their advantage, and a compromise section will prove more satisfactory. Oil-carrying vessels and lake ore carriers are an illustration of the case where the vessel runs for 50 percent of its time at a considerably reduced draft.

The underlying cause of the variation of resistance due to shape of section is probably to be found in the general conditions of stream-line flow at the ends, so that the prismatic coefficient of the ends, combined with the speed-length ratio of ends and also what might be called "diagonal fineness," will influence the results. Admiral Taylor's experiments on stream-line flow around vessels show conclusively that a good deal of the general flow is in a downward direction and, consequently, anything that can be done to make the path as easy as possible; *i. e.*, by paying some attention to the lower parts of the sections, particularly where these fair into the midship part, will probably reduce resistance.

Appendix

The effective horsepower of any ship taken as a model will be

$$\text{E.H.P.}_{1} = (f_1 S_1 V_1^{2.83} + R_w V_1) \times .00307$$

f_1 = Coefficient of friction for model ship.
S_1 = Wetted surface of model ship.
V_1 = Speed of model ship in knots.
R_w = Wave resistance of model ship in pounds.

At the same speed-length ratio the effective horsepower of a similar ship whose dimensions have the linear ratio λ to the model will be

$$\text{E.H.P.}_{2} = (f_2 S_1 \lambda^2 (V_1 \lambda^{.5})^{2.83} + R_w \lambda^3 V_1 \lambda^{.5}) \times .00307$$
$$= (f_2 S_1 \lambda^{3.415} V_1^{2.83} + R_w V_1 \lambda^{3.5}) \times .00307$$
$$\therefore \text{E.H.P.}_{2} = (\text{E.H.P.}_{1} \lambda^{3.5} - (f_1 \lambda^{3.5} - f_2 \lambda^{3.415}) S_1 V_1^{2.83} \times .00307$$

In terms of effective horsepower per ton of displacement, since displacement varies as λ^3:

$$\frac{\text{E.H.P.}_{2}}{\text{Dispt.}_{2}} = \frac{\text{E.H.P.}_{1}}{\text{Dispt.}_{1}} \lambda^{.5} - (f_1 \lambda^{.5} - f_2 \lambda^{.415}) \frac{S_1}{\text{Dispt.}_{1}} V_1^{2.83} \times .00307$$

Where the similar ship is only 10 to 12 percent longer or shorter than the model ship, the second term can be neglected without introducing any serious error, and the effective horsepower per ton obtained by multiplying the similar quantity for the model ship by $\lambda^{.5}$. The power so obtained is for the same speed-length ratio as in the model ship.

As an illustration, the following table has been prepared for a model ship of 425 feet:

Similar ship	λ	Beam	Beam = $\frac{L}{10}$ +	$\lambda^{.5}$	f_1	$f_1 \lambda^{.5}$	f_2	$\lambda^{.415}$	$f_2 \lambda^{.415}$	$f_1 \lambda^{.5} - f_2 \lambda^{.415}$
375	.882	49.5	12.0	.94	.....	.00853	.00913	.949	.00867	—.00014
425	1.00	56.0	13.5	1.00	.00908	......	......	....	......	......
475	1.118	62.5	15.0	1.057	......	.00960	.00905	1.047	.00947	+.00013

At the deepest draft the ratio of wetted surface in square feet to displacement in tons does not exceed 2.9 for the model ship, and for the lightest draft rarely exceeds 4.0.

At the high speed-length ratio for this type of .68, the value of $V^{2.83}$ is about 2,000. Using these values for a similar ship where $\lambda = .882$ the value of the corrections becomes:

$$+ .00014 \times (4 \times 2{,}000 \times .00307) = .0034$$

At the lowest draft the effective horsepower per ton of displacement of the model ship is about .30. If the simplified expression is used, the effective horsepower per ton for a similar ship will be $.3 \times .94 = .282$; and if the complete expression be used it will be $.3 \times .94 + .0034 = .2854$ at the same speed-length ratio.

In this extreme case the correction amounts to a trifle more than one percent.

Naval Architects to Hold Spring Meeting

THE Society of Naval Architects and Marine Engineers will hold a spring meeting at the Automobile Club of America, 247 West 54th street, New York, on Friday, May 19, 1922, at 8 P. M.

The meeting this spring will be of special interest to shipowners and operators. This is particularly appropriate at this time because Congress is about to decide whether or not America shall adopt constructive legislation that will insure the successful operation of an American merchant marine. It is of course evident that the future of all members of the society interested in the building of ships, propelling machinery, auxiliaries and of the material and equipment that enter into ship construction depends upon successful ship operation.

Capt. Eugene E. O'Donnell, manager, marine department of C. H. Sprague & Son, will deliver a paper entitled "Operating Problems of the American Shipowner."

Through the courtesy of the International Mercantile Marine Company it has been arranged for the members of the society to visit and inspect the *Majestic* from 2 to 5 in the afternoon. This ship is the largest vessel afloat, having a gross tonnage of 56,000 tons, which is nearly 10,000 tons larger than the *Olympic*. It presents many elements of design and construction of interest to members of the society, so than an inspection of the ship should prove of great interest and value to them.

An informal dinner will be served at the Automobile Club of America at 6:30 P. M. At this dinner there will be no formal speeches, but there will be an address by a distinguished authority on shipping matters.

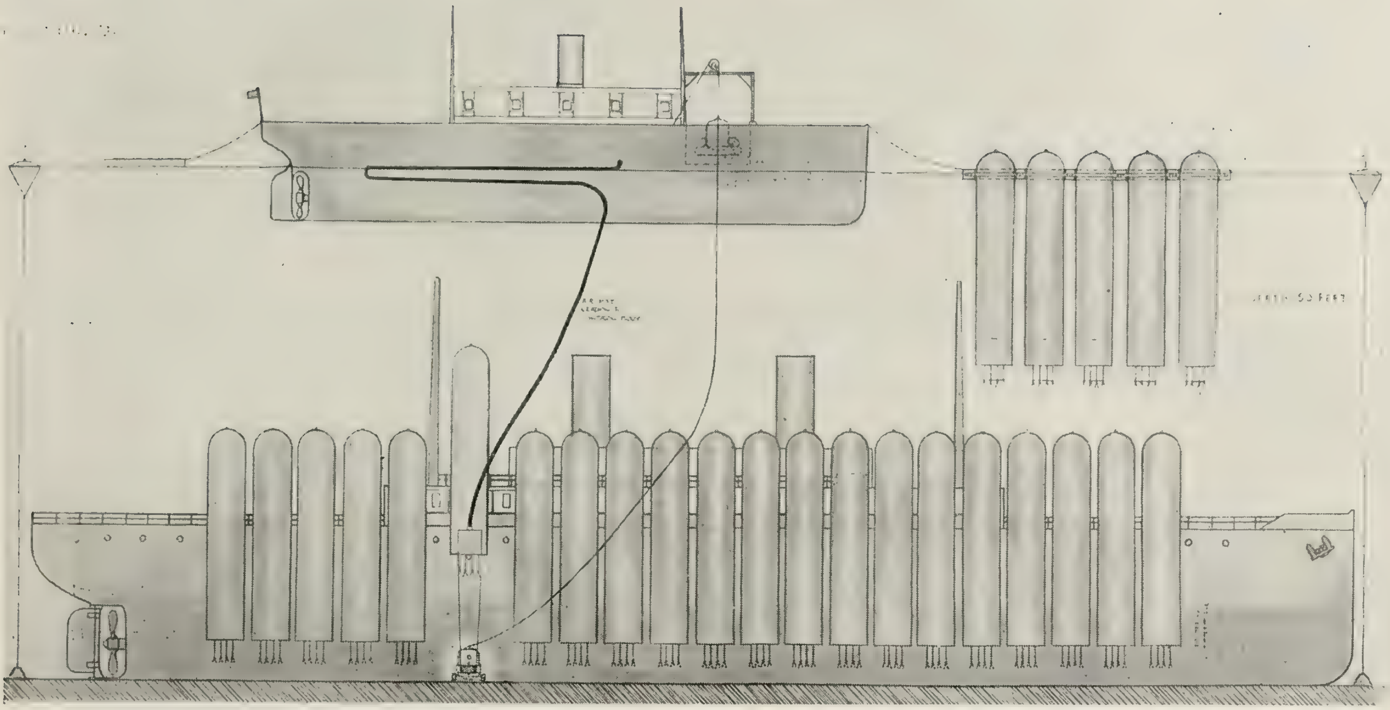


Fig. 1.—Sketch Showing Arrangement of Mother Ship, Submarine Tractor and Vertical Submerged Pontoons for Raising a Sunken Vessel

Vertical Submerged Pontoon System to Salvage Ships

Details of Proposed Method for Restoring Buoyancy to Sunken Vessels at Depths Up to 500 Feet

SYSTEMS of ship salvage employing surface pontoons have been used with success in raising vessels sunk in comparatively shallow waters, but although methods have been devised attempting to utilize similar principles in deeper water none has so far been particularly successful. A method recently developed, however, by Mr. Jesse W. Reno of New York, known as the Reno marine salvage system, offers possibilities for accomplishing the raising of vessels sunk at depths up to 500 feet by attaching a number of vertical submerged pontoons to the sides of the vessel and thus supplying the necessary buoyancy to bring it to the surface.

The location of the ship to be raised is first marked by two buoys at the bow and stern and a mother ship having control of the salvage operations is moored by cross anchors in a convenient position. In order to prepare the vessel for raising, a mobile working chamber, or submarine tractor, having two operators within it is lowered from the mother ship to the sea bottom. This submarine chamber is fitted for propulsion on the sea bottom with caterpillar tractor belts driven by an electric motor within the chamber. This motor also serves to drive twin boring drills and a windlass mounted on the platform of the machine. Current for the motor and for searchlights within the chamber is supplied from the mother ship as is also compressed air for filling the pontoons. Telephonic communication is provided through the lowering cable. Work is carried on in the submarine chamber under atmospheric pressure. The oxygen supply and the method of removing impurities from the air are similar to those employed in submarine boats.

With the working chamber on the sea bottom, the searchlights being turned on, the tractor belts are set in motion and the chamber brought alongside the ship where sets of 5-inch holes are bored through the ship's plates. These holes are located adjacent to the frames of the vessel so that subsequent strains in lifting are transmitted to the entire structure of the ship. The drills work simultaneously and tests have shown that a pair of holes can be completed in 4½ minutes. In the case of small vessels, holes are drilled in sets of four while in larger ships eight holes are necessary to accommodate the large size pontoons.

Arrangement of Lifting Pontoons

The second operation is the attaching of the pontoons which are cylindrical steel tanks closed at the top and open at the bottom. For general service it has been decided that pontoons 12 feet in diameter and 60 feet long are suitable, the number required being determined by the size of the ship to be raised. A vessel with pontoons attached is shown in Fig. 1. Fig. 2 indicates the method employed in attaching the lifting cables. These cables hang down from transverse girders within the pontoons and equalizing levers are arranged to insure equal loading of the cables. At the lower end of the cables are standard crane hooks which are inserted in the holes drilled in the ship's sides.

When preparing to sink the pontoons for attachment to a vessel they are partially filled with air, but only enough to keep them upright. This point is determined by an air valve in the head of each pontoon located so that surplus air escapes until the pontoon sinks in the water leaving its top awash.

The winding drum mounted on the submarine tractor is next brought into action. Two lengths of wire cable spaced about 8 feet apart and long enough to reach the surface are

unwound and a hollow steel float attached to them raises them to the surface. This float is fitted at the top with a hook made to fit into a staple near the bottom of each pontoon; the float being at the surface, a diver places his feet in suitable recesses in its side and signals the working chamber at the sea bottom to pull him and the float down. When he reaches the bottom of the pontoon he inserts the hook of the float in the staple of the pontoon and his work being complete, rises to the surface, after which the pontoon is drawn

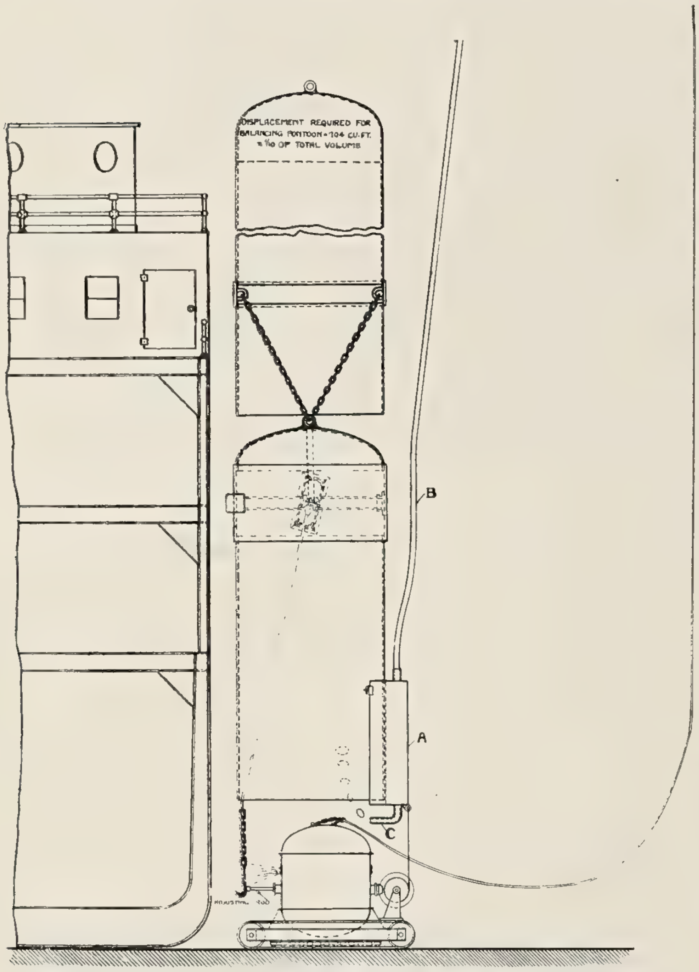


Fig. 2.—Method of Attaching Pontoon to Sunken Vessel by Submarine Tractor

to the bottom. The two cables insure the pontoon going down in proper position and a specially designed adjusting bar operated within the working chamber inserts the pontoon hooks in the holes drilled in the ship's side, Fig. 2.

Raising the Ship

With the pontoons in place it only remains to fill them with compressed air to raise the ship to the surface. A sea bottom syphon delivers the compressed air from the mother ship into each pontoon in turn. The end pontoons are first filled, those on the two sides alternately, to insure the proper balance, when the ship rises until it floats with its decks awash. From this point on the methods followed depend on the tides. If the rise of tide is sufficient, the ship is towed into shallow water, grounded at high tide and the pontoons removed. As the tide falls the water within the ship runs out through the numerous holes which at low tide are plugged by divers. The damage which caused the vessel to sink is patched and as the tide rises again the ship floats with her deck well above the surface of the water ready to be pumped out and towed into dock.

In locations where there is little or no tide a series of partially inflated box shaped pontoons may be placed under the vessel. The side pontoons are then partly deflated and drawn down one at a time by the cable drum on the working chamber and hooked along the lower edge of the box pontoons. The holes in the ship are then plugged, the box and side pontoons fully inflated and the added buoyancy raises the ship with its deck well above the surface ready to be pumped out.

Annual Meeting of the Institution of Naval Architects

THE Institution of Naval Architects held its annual meeting in the lecture hall of the Royal United Service Institution, Whitehall, W. C. 2, London, England, on April 5, 6 and 7, at which the following papers were presented:

"Merchant Shipping and World Commerce in Relation to Sea Power." By Sir Westcott Abell, K. B. E., M. Eng.

"Three Steps in Naval Construction—*King Edward VII—Lord Nelson—Dreadnought*." By J. H. Narbeth, C. B. E., M. V. O.

"Resistance of Ships Among Waves." By J. L. Kent.

"Nodal Arrangements of Geared Drives." By Dr. J. H. Smith.

"Double Reduction Gears in the S. S. *Melmore Head*." By J. W. Wilkie.

"A Method of Determining the Natural Periods of Vibration of Ships." By T. C. Tobin, M. A.

"Possibilities of Fuel Economy in Marine Boilers." By John Reid.

"The Metering of Steam." By J. L. Hodgson.

"Diesel Machinery for Single Screw Motorships." By James Richardson.

"Longitudinal Strength of Cargo Vessels and Its Variation with Fullness of Form." By E. L. Champness, M. B. E., M. Sc.

"Some Special Cases of Two-Dimensional Stress or Strain." By Prof. C. E. Inglis, M. A.

"The Economic Efficiency of Merchant Ships." By John Tutin.

"Recent Developments in Motor Lifeboats." By J. Rennie Barnett, O. B. E.

An evening reception at which the president, His Grace the Duke of Northumberland, received the guests, was held on April 4 and the annual dinner of the Institution was held on Wednesday, April 5.

The Council is arranging to hold a Summer Meeting of the Institution in Paris on July 4, 5 and 6, particulars of which will be issued in May.

New Type Expansion Joint

THE Ray Expansion Joint Company, Inc., of 95 Liberty Street, New York City, has recently introduced in the marine field a new type expansion joint consisting primarily of two flanges connected together by means of a flexible element, the flanges being guided relatively to each

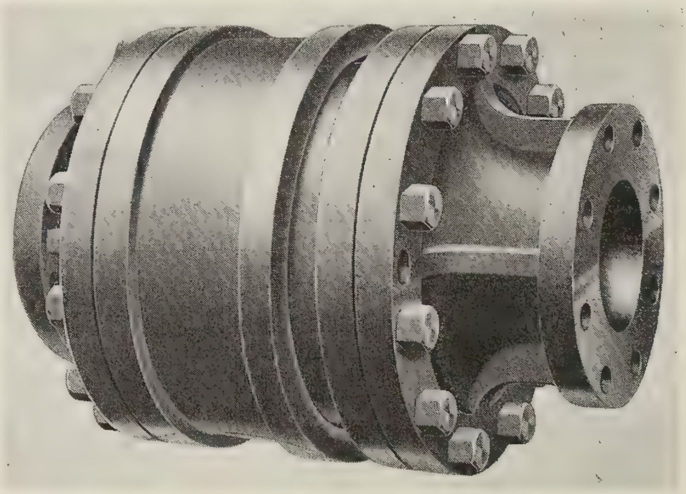


Fig. 1.—Ray Expansion Joint—Exterior View

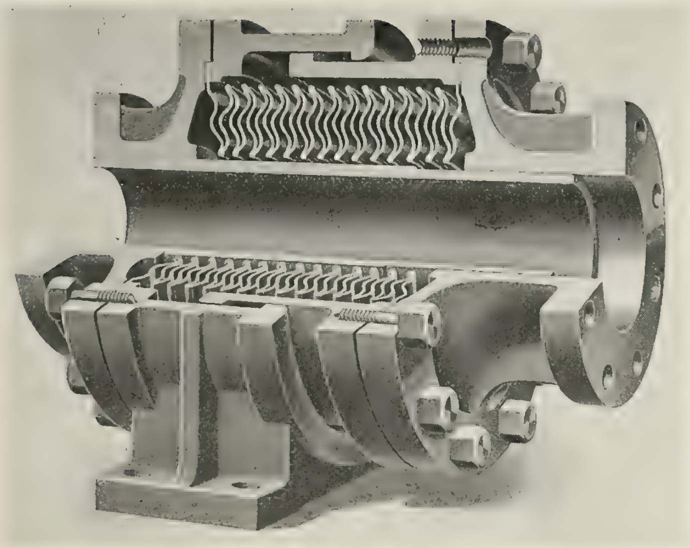


Fig. 2.—Ray Expansion Joint—Section Showing Details of Construction

other in such a manner as to permit longitudinal movement and at the same time prevent lateral movement.

The elastic element consists of a number of corrugated steel discs, alternately welded together at their inner and outer circumferences, the end discs being provided with enlarged flanges for attaching to the flanged end pieces. The discs are pressed from plates of special crucible nickel steel which, when subjected to the particular heat treatment given the completed element, has an elastic limit of approximately 170,000 pounds per square inch and an ultimate strength of about 220,000 pounds combined with great toughness or resiliency. Due to their construction and the special metal of which they are composed, these discs will function for long periods of time without giving way to fatigue caused by the alternating stresses to which they are subjected by the expansion and contraction of the pipe line.

A tube in the bore of the joint acts as a guide for the movable head and in addition to protecting the elastic element from the entrance of foreign bodies between the discs, prevents the escape of any appreciable amount of steam or liquid in case of a breakage in the elastic element. The construction is such that a slight leakage past this tube is kept within the elastic element because the end flanges are made absolutely tight with suitable gaskets.

One of the particular advantages claimed for this joint is the fact that it may be installed in inaccessible places such as the main suction lines aboard tankers and several large oil companies are considering the installation of these joints for this service.

While this new type of joint has not been in service long enough to determine the life of the flexible element under actual working conditions, the manufacturers estimate the life to be from ten to fifteen years. Even should the life, however, be limited to four or five years, the ease with which a new flexible element could be installed and the absence, during that time, of packing troubles would justify its use.

Ray expansion joints are made in standard sizes to resist oil or steam pressures up to 250 pounds and expansions up to three inches. Special designs, however, are available for joints with a total movement up to 16 inches.

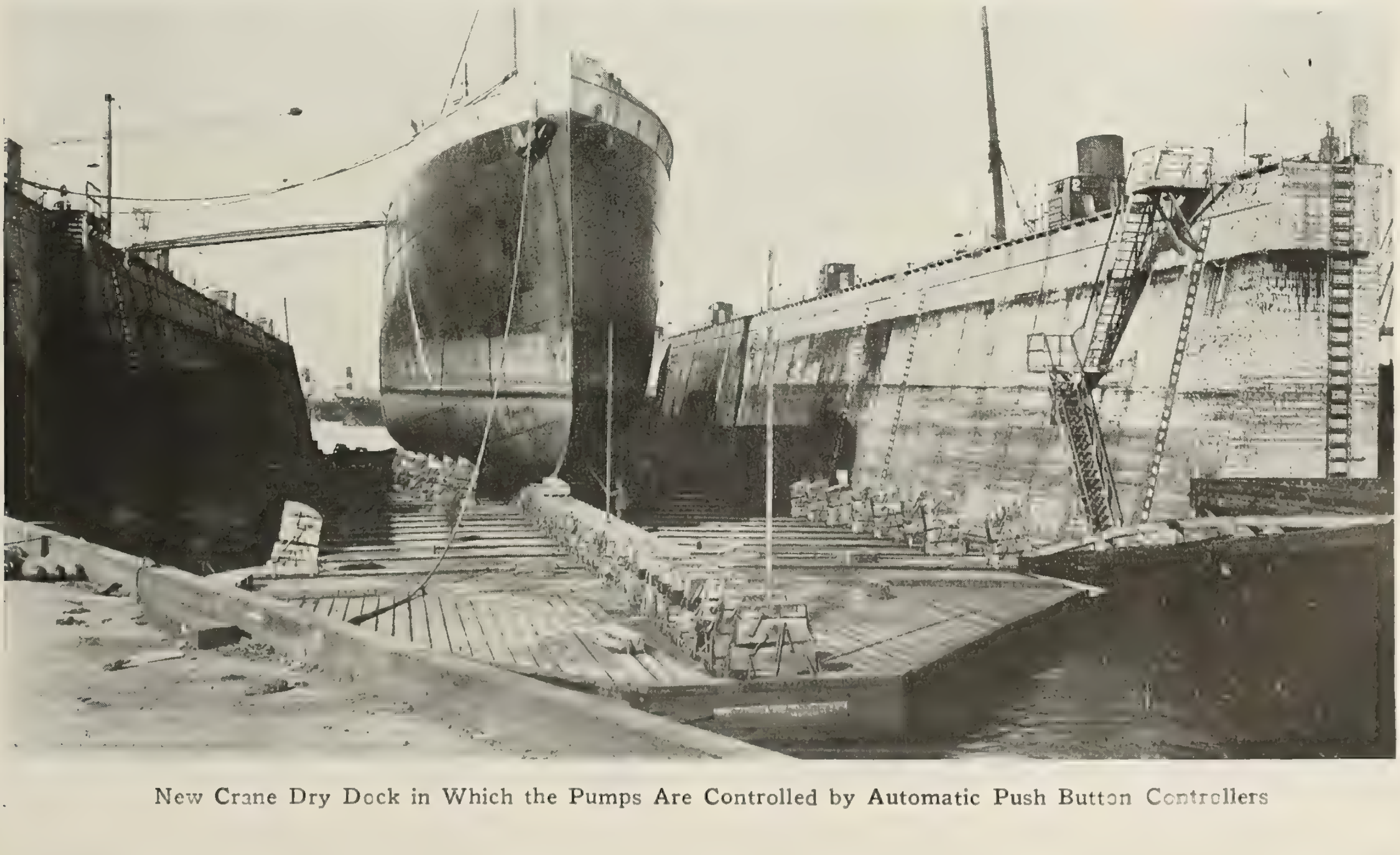
Controlling a Floating Dry Dock With Push Buttons

By James Goldsborough*

ONE of the latest developments in the control of dry docks is illustrated by the 14,000-ton, four-section, floating dock recently erected in the yards of Theodore A. Crane's Sons Company, Erie Basin, Brooklyn, N. Y.

All of the pumps are controlled directly by the dock master himself. He stands in a little house, directly facing the dock, where he has a clear view of all proceedings. Within this house is a waterproof cabinet which contains eight sets of push buttons, each set consisting of two buttons marked "start" and "stop," respectively. The sets are numbered

* Westinghouse Electric & Manufacturing Company.



New Crane Dry Dock in Which the Pumps Are Controlled by Automatic Push Button Controllers

One of Eight 125-Horsepower Motors Operating the Pumps

Dock Master's Push Button Control Station

from one to eight, and each controls one of the eight pump motors in the dock.

To start any or all of the motors, the dock master presses the proper "start" buttons; to stop them, he presses the "stop" buttons. Thus the control of the delicate operation of pumping out a dock is literally at his finger tips, and his days of bawling out orders, with the consequent loss of time and possibility of being misunderstood, are at an end.

This is one of the first instances of automatic electrical control of a dry dock, although this system has been successfully used in other industries, notably in steel mills, for many years.

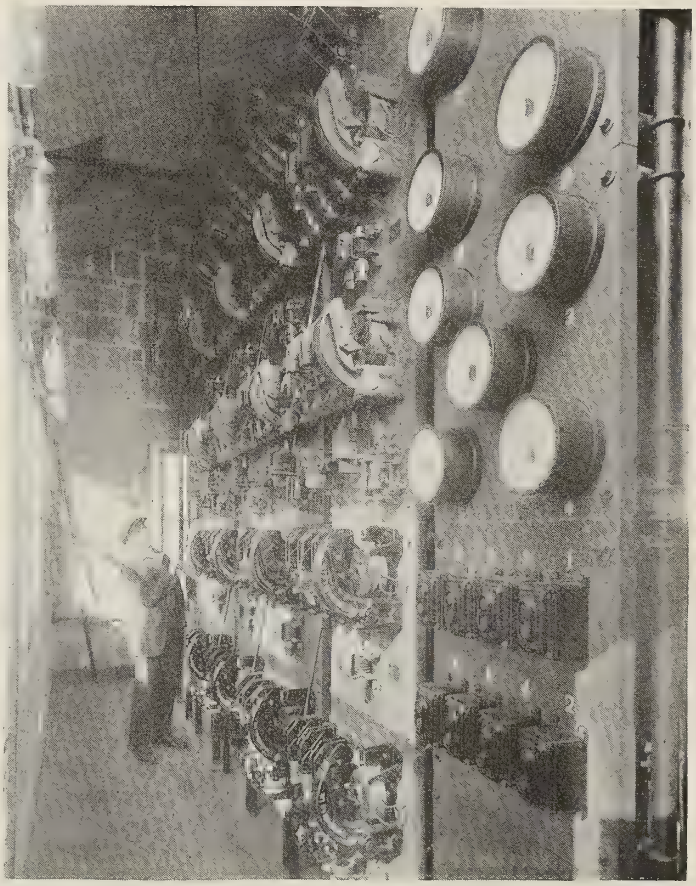
The Controller

The controller itself is located in the yard's substation. This consists of a large panel board carrying eight groups of magnetic contactors, eight ammeters, and eight sets of push buttons, which are duplicates of those in the dock control house. The actual motor connections are made by the contactors (and not by the push buttons), and these are so designed that they close in the proper order and at a rate that will start the motors in the least possible time consistent with safety.

The motors operate on 3-phase, 25-cycle, 440-volt current but are started by being connected with a 220-volt circuit. When the dock master presses the "start" button of No. 1 motor, for example, the contactors are energized and those that connect it to the 220-volt circuit close first. This application of low-voltage current starts the motor easily and brings it gradually up to speed. When the proper speed is attained, a relay mounted on the panel closes automatically, and the 440-volt contactors then close, connecting the motor directly to the running circuit. When the "stop" button is pushed, all contactors open and disconnect the motor.

The ammeters mounted on the control panel give the electrician in charge of the substation complete information as to the performance of the motors. By glancing at these instruments, he is able to determine whether or not each motor in operation is taking its full share of the load. Any irregularities indicated are immediately investigated, and troubles can often be remedied before actually developing

The duplicate set of push buttons in the substation provides control of the motors in case of trouble at the dock house, and also permits the electrician to act in case of an emergency.



Magnetic Contactors in the Yard Sub-Station. At the Right Are the Ammeters, Showing Operating Conditions of Each Motor; Below Them Is the Duplicate Set of Push Buttons

The motors are of the vertical squirrel cage type and are rated at 125 horsepower at 290 revolutions per minute. They are provided with ball thrust bearings and their coils are impregnated to render them weatherproof. They are mounted in little houses on the deck of the dock, and each is directly connected to an Alberger centrifugal pump.

Current for this installation is received from the Brooklyn Edison Company at 6,600 volts and is stepped down to 440/220 volts by three oil-insulated self-cooled transformers.

The dock itself cost over $1,000,000 and all of the wooden construction was handled by the yard. The marine construction engineer in charge was Henry J. Gielow of New York. All of the electrical equipment was supplied by the Westinghouse Electric & Manufacturing Company.

The Most Interesting Job in the Yard

If you are holding down an interesting job in a shipyard, have you become so absorbed in your own work that you have failed to realize the importance of the work in some of the other departments in the yard? Even if you haven't, it is more than likely that many of the men in the other departments have, and that, through ignorance or indifference, they know little about your job or its importance. Here is a chance for you to tell them, as a loftsman is doing in the letter printed below, and as others have done in previous issues, why yours is the most interesting job in the yard. Who's next!

While I am willing to acknowledge, when merely thinking is concerned, that the draftsman has "the most interesting job in the yard," I will not readily hand him the palm when it is a question of both thinking and acting. It then rightly belongs to the mold loftsman. Being a loftsman by trade, I am ready to defend the attributes of this vocation against all who may be skilled artisans in the marine engineering industry. Yes, even against those literati of the industry who use Latin in their discourses!

The loftsman dwells in an atmosphere of romance as well as accomplishment. Twenty-two years ago a group of American bridge builders began the task of building a ship at Camden, N. J. Confronted with the archaic British method of ship construction these gentlemen asked themselves why a ship could not be built as they had been building bridges. Thus, American inventive genius germinated the idea that has wrought a revolution in shipbuilding. Here, too, the fabricated ship was given birth, with the death-knell being sounded in America to the supremacy of old-world methods as well as old-world shipbuilders. The problems of a ship were found to be vastly different from those of a bridge; but fortitude and determination triumphed. Today the solution of all these difficulties is known to the modern loftsman, even though some are termed "impossible" by classics of the foreign shipbuilding technical world.

Revolution in Shipbuilding Began in the Mold Loft

Formerly the speed of ship construction was governed by the output of the punch shed which in turn relied on steel that had been templeted from the ship, a la the old scrive-board method. Today the mold loft can turn out a ship and keep three shifts going in the punch shed with three shifts of plate-hangers, if need be. The speed of ship construction at present depends, in the main, on bolting and riveting.

Here in the Pacific Northwest—even today a pioneer country—is a shipbuilding establishment (Skinner and Eddy Company, Seattle, Wash.) that made and held all records, during the late crisis, for fast ship construction. The factors entering into this achievement were: an efficient business organization; a capable and energetic works manager; a body of loyal workingmen; and a modern mold loft system. Even though the other factors were double as able, without the loftsman's valuable service no records would have been possible; for Britain, with her age-old family of shipbuilders, would easily have outstripped them. To the skilled art of the loftsman as to no other single factor—aside from the demand—goes the credit of shipbuilding in America emerging from 85th place in American industries in 1914 to 15th place in 1920, thus making us the shipbuilding nation of the world.

What the Loftsman Does

A skeleton outline of a loftsman's duties should convince the most skeptical of the merits of my claim. After the inspired genius of the drafting room has completed the ship's form to a ¼-inch scale, it is sent to the loftsman who lays the design down on the mold loft floor to full size. Working to measurements forty-eight times greater than the draftsman, the loftsman is enabled to round off unsightly corners, thus assuring a finished ship that will be fair and pleasing to the eye. With the completion of the lines, work is begun templeting the various constructional parts such as the frames, bulkheads, decks, shell, foundations, hatches, masts, etc. A paper or wooden templet is made to exact size for each piece of steel that enters into the hull of the ship, ranging from the largest shell plate to the smallest liner. While some parts are flat and some curved, a considerable amount is also twisted, testing severely both the skill and imagination of the loftsman. As all this work is laid out on the flat—in one plane—and although many checks as to its accuracy are applied, the actual success can be known only after fabrication and erection. The responsibility involved in the undertaking is a large one; but results, in percentage of error, show that the loftsman still remains, by a narrow margin, a member of human-kind.

Coincident with the templet work the loftsman provides the ship carpenter with molds enabling him to prepare the building slip for keel laying, stage building, etc. Later assistance is given in launching preparations when the steel poppets and tie plates for sliding ways are made.

The Loftsman's Directions Are Followed in Fabricating and Erecting the Ship

The work of the fabricating shop is carried on as directions of the loftsman indicate, with the following operations being performed on his orders: duplicating mold on steel, punching, shearing, planing, countersinking, knuckling, flanging, rolling, coping, slotting, drilling, chipping, calking, tapping, sawing, burning and welding. The frame bender is materially aided in all work under his care and the plate-furnaceman as well. The anglesmith staples, offsets, box-ends, etc., from molds supplied by the loft, and the solid-smith works flats and rounds, if need be. Even the heavy forger is aided when the occasion demands it.

The plate-hangers' job is now one of comparative ease as

the loftsman, by cutting, arranging and planning, has facilitated the easy shipping of steel. While the calkers and test-gang can make any tank, whether air, oil or water, tight with the aid of a red-lead gun, taps, steel shims, wedges and packing, the loftsman's accurate work has caused this practise to be well-nigh a lost art. In days of old the job of plating the shell of a ship was a nightmare; but, due directly to the loftsman, it is now quite a simple task, the hardest job at present being to secure good shell riveters. On all kinds of hull repairs the loftsman has lately left his mark, having made possible some of the quickest, most economical and largest repairs.

The patternmaker finds the loftsman indispensable on such work as stems, sternposts, sea chests, hawse pipes, bollards, chocks, torpedo tubes, spectacle frames, etc. The inside machinist following closely behind is also aided along these lines. The joiner has recourse to the loft on such work as pilot houses, cabins and quarters. It is thus, too, with the sheet metal worker who is assisted on light-gage bulkheads, ventilation, etc. Cooperation is extended to the boiler maker on condenser and boiler foundations, and in some yards the loftsman lays out uptakes, smokestacks, feed and filter, fresh water, gravity and sanitary tanks of all kinds. Out on the ship the loftsman assists the outside machinist in locating the position of pumps, engines and propeller shafting for boring. For the painter the freeboard marking, paint lines and draft marks are located. Incidentally, any work on board the ship entailing a knowledge of geometrical construction is performed by the loftsman.

The Language of the Blueprint

My contemporary, the draftsman, states that all "Nulli Secundus" has left to do is to "read the plan," which would be a simple matter, if it were on a par with reading Greek or Chinese for instance; then, when errors arose, they could be proved by the known laws of grammar. However, the language of the blueprint is not yet an exact science, all of which is known to the draftsman and offers him a nice loophole for escape when controversies arise. Even though it were, I believe that some of the more astute wielders of the right-line pen would claim the disputed points to be idioms, not readily understood by the yard force.

Hull construction foremen and superintendents possess a valued stock in trade called executive ability; but it will be found that this quantity—however elusive and intangible—varies in proportion to the very "practical" accomplishments of the yard's mold loft. The ratio would probably be thus: executive ability varies inversely to the cube as does the inefficiency of the mold loft directly to the square.

The Mold Loft a Clearing House of Information for the Whole Yard

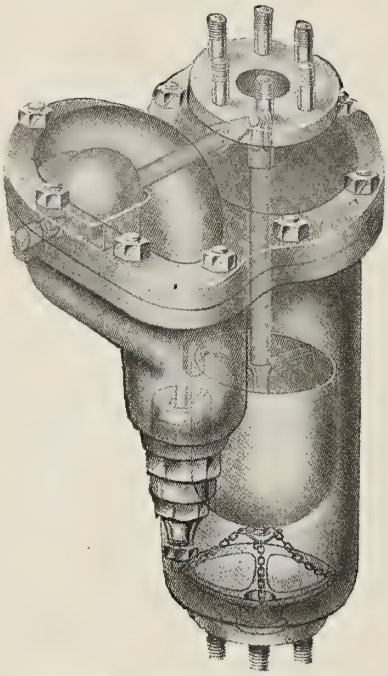
The mold loft is now a clearing house of information for the whole yard and the perfecting of the modern loft is the result of the cumulative effort of the men comprising its personnel, aided and encouraged by executives of vision. Unobtrusive perhaps the loftsman may be, and little seen or heard, yet his is a humility born of greatness. The multiple punch has tended to detract somewhat from his laurels and further inroads may be made with the perfecting of the welded ship; but in this march of progress the loftsman joins; for having in the past been a trail blazer he can still be found adapting himself to changed conditions and ever being a member of the vanguard of progress.

Seattle, Wash. Angus D. MacDonnell.

Shipping Board's Operating Loss in February.—The loss of the operating department of the Shipping Board for the month of February was reduced to $3,089,459, according to an announcement by Chairman Lasker. This was the best showing the board has yet made for any month. When the present board took office last year the average losses were between $11,000,000 and $12,000,000 a month. About 400 ships are now in operation, which is less than were being operated at that time, but freight rates are lower than then and the board is covering all trade routes. For January the operating loss was $3,445,447. The loss for February includes $593,290 on voyage operations. The tankers alone earned a profit of $534,481; charter hire amounted to $65,411; cost of repairs to $1,050,000; lay-up expenses to $413,076; insurance premiums to $320,355; salaries and wages to $477,546, and general expenses to $300,000. The board is not yet making public a detailed statement because it is still experimenting to ascertain the proper reserves to be used and it is stated that the loss might possibly be increased by some $400,000 if the reserve set up for repairs proves inadequate.

Automatic Oil Shut-Off for Oil-Fired Boilers

With the increased use of oil as a fuel aboard ship the necessity of providing an automatic check to the fuel feed in cases of low water in the boilers caused the Todd Shipyards Corporation, New York, to develop a device known as the Todd "Guardian" to eliminate this cause of danger in the boiler room of a steamship.



Safety Fuel Feed Shut-off

The device is operated solely by the changes in water level in a boiler which act on a bucket float partly filled with water suspended in one chamber of the apparatus. This float, as will be seen in the accompanying phantom sketch, is arranged with an anchor and chain suspension, which keeps it from touching the sides of the chamber. In addition to the float chamber, a similar chamber is cast in the body of the device at the top in which a cradle containing a steel ball is placed. The float bucket and cradle are connected by means of a rocker arm and spindle. The steam connection is at the top of the chamber and the water connection at the bottom.

When the water level in the boiler falls, it also drops in the float chamber until the danger level is reached, at which point the weight of water in the bucket produces a strong downward pull on the spindle connecting the cradle. This action of the spindle tips the cradle sufficiently to roll the ball from its place whence it drops on the ram head of a cartridge placed in the bottom of the chamber. The ram has a peculiarly shaped point which perforates a copper disk and allows the steam to escape through the opening thus made. This steam enters a stop valve above the diaphragm which automatically shuts off the oil fuel supply to the burners.

The cartridge is a complete unit in itself and can be inserted after the device has functioned. Before it is put in place, however, the ball must be pushed back into the cradle by means of a rod.

Cement and Concrete for Shipbuilding Purposes

By Horace Holden Thayer *

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials' point of view.

WHEN the word "cement" is used without qualifying adjectives in connection with shipbuilding work, it is generally understood to be a mixture of Portland cement, sand and water which might more properly be called Portland cement mortar. Concrete is invariably such a mixture together with coke or other so called coarse aggregate. A few special cements which may properly be considered in this article will be dealt with at the end of the article.

Tentative standard specifications have been prepared and submitted as a progress report by a joint committee on standard specifications for concrete and reinforced concrete made up of representatives of the American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, American Concrete Institute and the Portland Cement Association. When these specifications are hereinafter referred to they will be called "Tentative Standard Specifications."

The Concrete Ship Section of the United States Shipping Board Emergency Fleet Corporation, working in close collaboration with the United States Bureau of Standards did a vast amount of research and experimental work necessitated by the concrete ship construction program. When reference is made to their work or the results obtained from it they will be called, for short, the "Shipping Board."

Nature of Cement and Concrete

The Portland cement in cement and concrete mixtures is partly dissolved by the water and partly held suspended in the solution. It passes through a succession of chemical reactions and eventually begins to set by the formation of interlocking crystals and by the development of colloids or glue like masses. These crystals and colloids acting by themselves have comparatively little strength but when acting as a binder between the particles of sand in cement or as an active part of this cement in the voids of the coarse aggregate of concrete, they develop great cohesive and adhesive power and form an artificial stone.

Reinforced concrete is not rigid but is quite elastic within a moderate range. It is not brittle and is most difficult to break up. Local shocks may puncture it if heavy enough and heavy shocks may cause cracks, but these do not destroy the efficiency of the concrete as a whole. Concrete itself apart from any free alkali content is not affected by sea water.

The proportions of the different elements in concrete have been pretty well standardized for ordinary practice, but for special work like the construction of concrete vessels, which requires maximum strength and density, accurate tests should be made of any new product as well as of the materials. The latter should be selected, graded and proportioned so that the number and size of the voids will be reduced to a minimum. There should be sufficient Portland cement to thoroughly coat every particle of sand and coarse aggregate and to fill all voids between the particles of sand; there should be sufficient sand to form with the Portland cement and water an amount of mortar slightly in excess of that required to fill all the voids between the pieces of coarse aggregate; and there should be only sufficient water used to hydrate the Portland cement, to take care of all possible absorption of water by the dry aggregate and to render the entire mass sufficiently plastic to compact itself and to readily adjust itself to the forms.

Uses of Cement

Cement is a valuable product on shipboard. Some of its uses have been already referred to. The more important of them may be tabulated as follows:

Deck covering.
Base for other deck coverings.
In the bottom of steel ships, including the lower turn of the bilge, efficiently covering the plates, frames and rivet heads. This is a classification society requirement.
Between floors in peaks and bilges to avoid water pockets below drainage holes.
Temporary repairs on all ships.
Inside of fresh water tanks.
Cement wash in tanks and double bottom compartments which do not carry oil.
Cement powder dusted into liquid tar on tank tops.
On tank tops.
Under and in front of boilers.
Calking material.
To stop local corrosion.

Uses of Concrete

Concrete is of particular value only for the construction of concrete ships; though it is used on other ships where considerable volumes of material have to be filled in, such as between floors in the peaks, where a saving in weight or cost can be effected by using it instead of cement.

Portland Cement

Portland cement is defined by the American Society for Testing Materials as the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum. A free translation of the foregoing is that shale or cement rock with limestone and possibly a little earth are mixed in the proper proportions to produce the desired material and roasted in rotary kilns. A little gypsum, not over 3 percent, may be added to regulate the setting action. The fused material is ground to a fine powder, which powder is Portland cement.

Very complete and detailed specifications for this material and the methods of determining its properties have been adopted by the American Society for Testing Materials as their Standard specification C9-21, and they have also been made a part of the Tentative Standard Specifications, and been made the standard of the Navy Department, the American Engineering Standards Committee, and other bodies. The requirements of these specifications, which illustrate the essential qualifications of the material, are:

Chemical Limits

The following limits shall not be exceeded:

Loss on ignition, percent 4.00

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

Insoluble residue, percent	0.85
Sulphuric anhydride (SO_3), percent	2.00
Magnesia (MgO), percent	5.00

Specific Gravity

The specific gravity of cement shall be not less than 3.10 (3.07 for white Portland cement). Should the test of cement as received fall below this requirement, a second test may be made upon an ignited sample. The specific gravity test will not be made unless specifically ordered.

Fineness

The residue on a standard No. 200 sieve shall not exceed 22 percent by weight.

Soundness

A pat of neat cement shall remain firm and hard and show no signs of distortion, cracking, checking or disintegration in the steam test for soundness.

Time of Setting

The cement shall not develop initial set in less than 45 minutes when the Vicat needle is used or 60 minutes when the Gillmore needle is used. Final set shall be attained within 10 hours.

Tensile Strength

The average tensile strength in pounds per square inch of not less than three standard mortar briquettes composed of 1 part cement and 3 parts standard sand, by weight, shall be equal to or higher than the following:

Age at test, days	Storage of briquettes	Tensile strength, pounds per square inch
7	1 day in moist air, 6 days in water	200
28	1 day in moist air, 27 days in water	300

The average tensile strength of standard mortar at 28 days shall be higher than the strength at 7 days.

The Navy Department specifications are identical with specifications C9-21 of the American Society for Testing Materials, except that the Navy Department has inserted a sentence in the part of the specifications dealing with the determination of fineness which states that no greater amount of residue on a No. 200 sieve than the above mentioned 22 percent will be allowed.

The Shipping Board specified a more finely ground Portland cement, thereby enabling the production of a more plastic concrete and one subject to less change in volume than when Portland cement of the normal fineness is used. Their specifications require 90 percent to pass a standard No. 200 sieve.

This is probably a good place to state that standard sieves are based on a "Table of Fundamental Data on Standard Specifications for Sieves" issued by the Bureau of Standards in 1920; that they have square openings; that for sieve sizes ⅜ inch and larger the size is the size of the opening; and that the number given to the smaller sieves is the standard number of wires per inch, and the approximate openings and wire diameters in inches are as follows:

	Sieve Opening	Diam. of Wire
200	.003	.002
100	.006	.004
50	.012	.008
30	.02	.013
20	.0335	.0165
16	.0412	.0213
8	.092	.033
4	.20	.05

Sand

The sand or fine aggregate used in cement and concrete must be sharp. Seashore sand will not answer as the particles are worn round and smooth by the action of the water. The sand may be either natural siliceous sand or screenings from crushed quartzite or equally hard rock. It should be well graded and free from dust, clay and other deleterious matter. The Navy Department requirements for sand are that the sand used shall be clean and sharp and shall be such as to pass through a No. 20 sand sieve, and be retained on a No. 30 sieve, the sieves to conform to the standard sieve specifications of the Bureau of Standards; and that sand having passed the No. 20 sieve shall be considered standard when not more than 2 grams pass the No. 30 sieve after one minute continuous sifting of a 200-gram sample.

The Tentative Standard Specifications state that it shall range from fine to coarse and be preferably within the following limits:

Passing through No. 4 sieve	not less than 95 percent.
Passing through No. 50 sieve	not more than 30 percent.
Weight removed by decantation	not more than 3 percent.

They also state that the fine aggregate shall preferably be of such a quality that mortar briquettes, cylinders, or prisms, consisting of one part by weight of Portland cement and three parts by weight of fine aggregate, mixed and tested in accordance with the methods described in the "Standard Specifications and Tests for Portland Cement," will show a tensile or compressive strength at ages of 7 and 28 days not less than that of 1:3 standard Ottawa sand mortar of the same plasticity made with the same cement. However, fine aggregate which fails to meet this requirement may be used, provided the proportions of cement, fine aggregate, coarse aggregate and water are such as to produce concrete of the strength specified.

The standard Ottawa sand referred to is natural sand mined at Ottawa, Ill., screened to pass a No. 20 sieve and retained on a No. 30 sieve. It is the sand that is standard for use when testing Portland cement.

The Shipping Board requirement was that the fine aggregate when dry should pass a standard 3/16 inch mesh screen.

Coarse Aggregate

The usual requirements for the coarse aggregate are that it will be crushed stone, gravel or similar inert material, clean, hard, strong and durable, and free from soft, flat or elongated particles, or alkali, organic or other deleterious matter. Stone and gravel are, however, too heavy for shipboard service.

Coke is a good material when the concrete is used for filling in between floors in vessels and similar service. The Navy Department allows the use of coke crushed to small size where such filling has a depth over 3 inches. They require that a thin coat of cement mortar about one inch thick be first put on; then that the space to be protected be filled with fine coke and a cement mortar grout be poured over it filling the voids; and finally that it be finished off with a 1-inch coat of fresh mixed cement mortar sufficiently stiff to be trowelled to a surface. This is a good procedure to adopt generally.

As weight is one of the great handicaps of a concrete ship, it is essential that the coarse aggregate be as light as possible while still giving the concrete the necessary strength and impermeability. The Shipping Board developed an aggregate of bloated clay which floats on water. Concrete made of it weighs less than 110 pounds per cubic foot, which is 20 percent less than that obtained from normal sand and gravel aggregates. In addition to the light weight it has great strength, giving in excess of 4,000 pounds per square inch (in 28 days) in mixtures required in ship construction as compared with 2,000 pounds per square inch for much of the concrete used in ordinary building construction. This aggregate also makes a concrete having an impermeability equal to or greater than with sand and gravel aggregates.

The size of coarse aggregate depends upon the character of the work and no attempt is made in the Tentative Standard Specifications to specify it except to define it as aggregate that is retained on a No. 4 sieve, and of a maximum size generally not larger than 3 inches and to limit the amount that will pass a No. 4 sieve to not over 15 percent and the amount that will pass a No. 8 sieve to not over 5 percent. In the Shipping Board's concrete ships, the coarse aggregate when dry was required to pass a sieve having ⅜ inch square openings, and to be retained on a sieve having 3/16 inch round openings.

Water

The water used in making cement and concrete should be clean, preferably of drinking quality, and free from oil and alkali or other deleterious substances. The Shipping Board required samples to be submitted for their approval.

The amount of water used in making concrete is an important factor. There should be sufficient to take care of the duties previously mentioned and, with these taken care of, the less excess water the better. With too much water the crystallization of the Portland cement may be incomplete and the slower hydration into colloid forms be badly affected. An excess of water tends to prevent the deposit of a uniform film of the hydrating cement on all surfaces of the aggregates and tends to allow the larger and heavier pieces of aggregate to sink to the bottom, where they form a definite stratum poorly connected together and often so full of voids as to provide easy passage to percolating water. With very wet mixtures any fine sand or dirt will flow to the surfaces and into the corners and result in crazing and cracking. An excessive use of water is particularly serious in concrete for shipbuilding purposes because the porosity of concrete results to a considerable extent from the leaching out or evaporation of excess water; the greater the amount of water, the greater the volume of the pores or voids, both strength and permeability being thus affected.

It has been proven that the strength of concrete decreases rapidly when the water content is increased beyond a certain point. This point for any particular mixture is difficult to determine exactly on account of the great variation in absorptive properties of the aggregates, even when from the same source. The Bureau of Standards has compiled a great deal of information regarding this in their Technologic Paper No. 58, on the "Strength and Other Properties of Concrete as Affected by Materials and Methods of Preparation." They show that a gravel concrete requires less water than a crushed sandstone concrete, and a crushed granite concrete requires less than either. They conducted a large number of compression tests in which aggregates from many sources were used in varying proportions, with a measured water content modified as required by the differing coefficients of absorption of the aggregates to produce mixes of certain consistencies, of which the three most commonly used are defined by them as follows:

Quaking—A stiff mixture upon which water can be brought to the surface by slight tamping. The mass should not flow readily.

Mushy—A soft, mushy mixture which is not watery, but can be spaded and readily worked into place in the form.

Fluid—A watery mixture which flows readily into place in the form with little or no working.

Typical figures from these tests, made with small cylinders of one color, two colors and four colors, mixes of crushed granite and of gravel concretes are:

Ultimate Stress in Pounds per square inch
Crushed Granite
Concretes

Consistency	*Fluid*	*Mushy*	*Quaky*
Percent water	9.0	8.0	6.9
Age—4 weeks	2683	3480	4000
Percent water	9.0	8.4	7.0
Age—52 weeks	4908	5299	6278

The tests revealed almost without exception that the quaking and mushy consistencies gave the greater strength, the former, in all but a few cases, giving better results than the latter, while the fluid or watery mix made a comparatively poor showing.

In the report accompanying the records of the tests, it is stated that the most satisfactory consistencies of concrete, from the standpoint of strength and durability, are the quaking and mushy mixtures and the error should be made

(*Continued on page 336*)

Steamship Leviathan as She Appears in Her Berth at the Yard of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Design of Hand Gear for Steam or Electro-Hydraulic Steering Machinery

Q. (1154).—When designing a hand gear for a steam or hydraulic-electric steering gear, what is the ratio of power required to that of the main gear? In other words, how many pounds pull and at what speed should it be applied to the hand wheels? How long should it take the hand gear to pull the rudder from hard over to hard over in the event of the main gear having broken down? Are there any books or pamphlets published dealing with the design of deck machinery?

A. (1154).—The following tabulated data will, it is thought, answer your questions better than a more general discussion:

	No. 1	No. 2
Type of ship	Passenger	Tug
Displacement in tons	10,000 to 12,000	200 to 225
Length in feet	460	85
Speed in knots, when hand steered	about 10½	9 to 10
Number of men at hand wheels (total)	6	1
Number of hand wheels	3	1
Type of main steering gear	electric screw	hand
Diameter of hand wheel to center of grips, inches	72	48
Diameter of rope drum, if fitted, inches	..	6
Hand gear connection to main driving shaft	clutched direct	..
Screw gear, double acting	7¼" outside dia., 1½" lead	..
Radius of rudder crosshead or tiller, inches	28	54
Pounds pressure at steering wheel per man	allowed 30	**28 by test
Type of rudder	single plate, unbalanced	wood unbalanced
Rudder area in square feet	157	33½
Width of rudder in fore and aft direction, inches	111	51
Number of turns of hand wheel, hard over to hard over	..	4¾
Time, hard over to hard over	*90 seconds	..

For comparative purposes the following may be of value:

Kent's handbook gives for a man turning a crank or winch as follows

R = resistance in lbs.	12.5	18	20
V = ft. per sec.	5	2.5	14.4
T = hours per day	..	8	2 minutes
RV = ft. lbs. per sec.	62.5	45	288
RVT = ft. lbs. per day	..	1,296,000	..

Smeaton is authority for the following: "A man draws horizontally 70 to 80 pounds, and thrusts at the height of his chest 28 or 30 pounds. . . . The force of a man in turning a winch is taken at 116 pounds."

I am unable to refer you to a book on deck machinery. I should say that conscientious study of the principles of machine design as applied to the design of the different types of deck machinery for which you might be able to secure detailed information from the manufacturer is about the only course open to you.

*This is an extreme arc of 35 degrees from about 20 degrees one side of center line to 15 degrees the other, it being impracticable to obtain more with the hand gear.

**This was found too great for satisfactory continuous operation. It was reduced to about 18 pounds by the introduction of a 2 part purchase in each tiller lead

Metacentric Height and Freeboard for a Tug

Q. (1155).—Do you consider 18 inches of metacentric height sufficient for a tug? Is 2 feet of freeboard enough?

A. (1155).—It is assumed from the figures given that you have in mind a harbor tug, steam driven, and from 85 to 100 feet in length. Of ten such tugs, for which the writer has reliable data, the metacentric heights are generally in excess of 15 inches, ship light, and from 18 to 30 inches, ship in loaded condition. The freeboards of these tugs at the half length are, in the loaded condition, generally in excess of one foot, while in the normal service condition they approach two feet.

The real criterion is not either metacentric height or freeboard taken individually. It is rather a composite of the value of the maximum righting, the angle of heel at which it occurs and the maximum range of stability. For tugs of the type in question a maximum righting arm of 0.6 to 0.8 foot, occurring at from 25 to 35 degrees angle of heel and a maximum range of stability of at least 50 degrees, all in the normal or service condition, should give satisfactory results.

Weights of Auxiliary Machinery

Q. (1163).—Will you please give separate formulas for determining the weight wet and dry of each of the following auxiliary engines: Condenser, heater, air pump, feed pump, etc. Also for the weight of the following machines: Lathe, planing machine, slotting machine, motor, drilling machine, etc.?

A. (1163).—The writer is unable to answer this question as fully as he would like, owing to the fact that machinery weight estimates are usually determined where possible by comparison with data already at hand of similar units; or, where information is not available for comparison, they are usually obtained from the manufacturers.

It would be impossible to derive formulas which would cover condensers as a class, owing to the fact that the type of vessel upon which they are to be installed generally governs their design as to form and lightness. What has been said of condensers also applies to other units.

The following are a few approximate rules which may be used for weight estimates:

Condensers, shell, of plate construction.	Dry	Wet
Heavy naval and merchant marine, pounds per square foot	5 to 6	6 to 7
Auxiliary condensers	5½ to 6½	6¼ to 7¼
Light fast craft	3½ to 4	4¼ to 4¾

Feed water heaters, shell, of plate construction.

Coil type, pounds per square foot, dry	= 12
Film type, pounds per square foot, dry	= 24
Straight tube type, pounds per square foot	= 5 to 6½

Air Pumps: For dry weight allow about 480 pounds per cubic foot of volume swept through by all pistons; i. e., 480 times the total area corresponding to the diameters of all pistons multiplied by the length of stroke.

LETTERS TO THE EDITOR

Diesel Electric Propulsion Versus Direct Drive

The article appearing in your February issue by Commander S. M. Robinson entitled "Diesel Electric Propulsion of Ships" has been read with much interest, as this subject is at present keenly discussed in this country, and pronouncements from brother engineers in the States are given close attention.

While in the main, the views of the author appear to be substantially the same as those of the leading engineers here, there are some statements made with which agreement cannot be expressed, and this letter is written with the object of obtaining further elucidation as to what is in the author's mind.

The statement that the Diesel is inherently poor in maneuvering qualities is far too sweeping an assertion to make and, while this reproach may be leveled at some designs, yet in the type built by my firm, Messrs. William Beardmore & Company, Dalmuir, Scotland, i.e., the Beardmore-Tosi four-stroke engine, these qualities of maneuverability and flexibility excel those of a steam engine. In the motorship *Pinzon,* recently completed—a single screw ship of 1,200 brake horsepower—the response to an intensive series of 85 telegraph orders was perfect. In this engine the speed can be reduced without misfiring to one-fifth of the designed full speed. While it is quite true that air must be used for this purpose, yet, it is not clear why air at 350 pounds per square inch pressure should be "not only entirely unsatisfactory, but distinctly bad," while injection air at 1,000 pounds is—except in the case of the few solid injection engines—essential for the operation of the engine at all, whether driving a generator or a propeller. While it is admitted that air starting bottles may be dispensed with, injection air bottles still remain.

It is agreed that the higher the speed of revolution, the more efficient the engine as a prime mover for driving generators becomes, but it is undoubtedly a fact that the fast running engines driving dynamos in present motorships give infinitely more trouble in their maintenance than the relatively slow moving main propelling units, and there is a general tendency in this country to limit the speed of such machines to 250 revolutions per minute. (With a multiplicity of these small fast running units installed in a high powered ship, the lot of the engineer would scarcely be enviable.)

Commander Robinson quotes an example of a 2,000 shaft horsepower ship driven by twin Diesels at 150 revolutions per minute, but such a practice is practically unheard of over here, the figure being usually 110 to 120, which with a twin screw vessel does not mean excessive loss of propeller efficiency, whereas a 2,000 horsepower motor running at 90 revolutions per minute is an enormous and costly item and provides no stand-by in case of disablement.

In discussing the choice of current, Commander Robinson's remarks regarding the use of series coupled direct current machines are quite concurred in but, so far, it does not appear that a case for alternating current for any ship of the powers at present suitable for Diesel electric drive can be made out. The necessity for extremely close governing and the maintenance of the propelling motors at a speed corresponding to the periodicity, irrespective of the fact that the alternator is essentially a machine more suitable for running at thousands of revolutions rather than hundreds, would put this type quite out of the running as a commercial proposition.

The statement that the Diesel electric drive would be suitable for installation in the Emergency Fleet Corporation ships with a resulting fuel consumption of one-third of the present figure seems to be open to question. It is highly improbable that this drive could be accomplished under 0.5 to 0.6 pound per shaft horsepower hour, so that if the existing turbine plant utilizes three times this amount, i.e., 1.5 to 1.8 pounds of oil, then there is something radically wrong with the present equipment.

For double purpose, vessels of moderate power, such as trawlers, cable steamers, ferryboats and, in some cases, yachts, the Diesel electric drive is ideal, the sole detriment being its first cost, but for very high powers, e.g., the 48,000 horsepower design shown for a capital ship, it is quite outside the range of practical possibilities at the moment. A six cylinder engine developing 1,000 brake horsepower per cylinder is still in the future. It is doubtful if any navy would risk installing such an equipment without cautiously feeling its way through the more moderate powers at present successfully tried out, i.e., say 300 horsepower per cylinder.

Commander Robinson closes with the truly amazing statement that the crosshead engine is still in its infancy! He does not appear to realize the limitations of this method of propulsion—excellent though it is in many cases—and would seem to be imbued with the conviction that the system is the one solution for all classes of ships' machinery.

R. J. Butler, M. I. N. A.
Messrs. William Beardmore and Company
Dalmuir, Scotland

Commander Robinson Replies

I have noted the criticism of Mr. Butler, of Messrs. William Beardmore & Company, on my article appearing in the February issue of your publication. Some of these criticisms relate to points on which views must necessarily be merely matters of opinion but others cover points which it would seem that data now available are sufficient to cover and consequently I would like to reply to the criticism on these points.

The first point raised is in connection with the maneuvering qualities of Diesel engines. I think Mr. Butler missed the point of my article in this connection. It is, of course, a well-known fact that Diesel engines can be built which can be maneuvered by the use of air, but it seems to be also a well established fact that such engines have to be built extremely heavy to take care of the stresses set up by this method of control and, if the Diesel engine is to progress and be built in large sizes for marine purposes, it would seem that some other solution rather than air for maneuvering must be found. Mr. Butler makes the point that it is necessary to use air at 1,000 pounds for injection at all times and, therefore, the use of air at 350 pounds for maneuvering should cause no ill effects. I must confess I cannot see the connection between the use of air for injection and the use of air in the cylinders for maneuvering.

In regard to the use of single screws and twin screws, Mr. Butler makes the point that single screws provide no standby in case of disablement. The answer to this is that up to the advent of the Diesel engine practically all cargo ships were built with a single screw, and this seemed to provide sufficient reliability. If electric propulsion is used for a single screw, it would always be desirable to provide two motors for the shaft so that duplication would be provided so far as the machinery is concerned. As regards the comparative efficiencies of single screws and twin screws, assuming the latter can be operated at the most efficient speed, the arguments all seem to be against the twin screws in spite of the data that have been appearing on this subject recently. It is significant that until ships began to be propelled by Diesel engines no one questioned the superiority of the single screw for propulsion purposes.

Exception has been taken to the statement in my paper that a crosshead engine can almost be said to be still in its

infancy. The intent of this statement was apparently entirely misunderstood. It was not intended to convey the impression that reliable crosshead engines were not being built at the present time—in other words, the infant is quite strong and sturdy—but it was intended to mean that the probable development of large Diesel engines will be by the use of this type of engine.

Bureau of Engineering, Navy Department, Washington, D. C.

S. M. Robinson, Commander, U.S.N.

Cement and Concrete for Shipbuilding Purposes

(*Continued from page 333*)

on the side of using too little rather than too much water, providing the concrete is properly spaded or worked into place in the forms.

Some of the valuable conclusions derived by the Bureau of Standards from these tests are:

"A concrete having a desired compressive strength is not necessarily guaranteed by a specification requiring only the use of certain types of materials in stated proportions. Only a fractional part of the desired strength may be obtained unless other factors are controlled.

"The compressive strength of a concrete is just as much dependent upon other factors, such as careful workmanship and the use of the proper quantity of water in mixing the concrete, as it is upon the use of the proper quantity of cement.

"The compressive strength of concrete may be reduced by the use of an excess of water in mixing to a fractional part of that which it should attain with the same materials. Too much emphasis cannot be placed upon the injurious effect of the use of excessive quantities of water in mixing concrete."

(*To be continued*)

PERSONAL MENTION

A. P. Hammond has been selected as Pacific coast manager of the Atlantic Gulf & Pacific Steamship Company.

Frank J. Skala has been made general western agent for the United States Lines. Mr. Skala will have his headquarters in Chicago.

Col. E. H. Shepperd recently retired as comptroller of the United States Shipping Board and has been assigned to do special work with the finance department.

L. M. Stevens, of Philadelphia, formerly general auditor of the United States Shipping Board, has been appointed to succeed Col. E. H. Shepperd as comptroller of the board.

Captain Francis H. Robinson, for the past three years president of the National Interocean Corporation, has been made general freight agent of the Williams Line in New York.

B. L. McMullen has been named Seattle manager for the Crowell & Thurlow Steamship Company. He was formerly in charge of the Sudden & Christensen agency at Portland, Oregon.

Charles F. Duisenberg has been appointed San Francisco agent for the North German Lloyd Steamship Company. This company has not been represented in San Francisco since 1916.

Frank S. Dickson, for some years adjutant-general of Illinois, has been selected by President Harding to become assistant treasurer of the United States Shipping Board and Emergency Fleet Corporation.

Henry Cave, formerly with the London branch of the Shipping Board, has been appointed superintending engineer of the Stockholm district with offices at Stockholm, Sweden.

W. E. Griffith, district director of the Hampton Roads district, has been appointed to the position of manager of the operating department of the United States Shipping Board Emergency Fleet Corporation with headquarters at Washington.

C. J. Janssen has been made freight traffic manager of the United States Navigation Company of New York. He was formerly export freight contractor with R. D. White & Company and prior to the war was with the Hamburg American Line.

OBITUARY

James Tregarthen, president and founder of the shipbuilding firm of James Tregarthen & Sons, died at his home in Brooklyn, N. Y., April 11, at the age of 80 years. He was born at St. Mary's, in the Scilly Islands, England, and served his apprenticeship as a shipbuilder in Newport, Wales. In 1861 he came to America and followed the shipbuilding industry here until his death.

Charles L. Seabury, senior member of the firm of Seabury & de Zafra, Inc., New York, consulting naval architects and marine engineers, died at the New York Hospital, April 7, at the age of 62. He was born at Tiverton, R. I., in 1860, and at an early age began work in the Herreshoff yacht works at Bristol. Later in New York he was with the Gas Engine & Power Company, builders of small boats. Here he was instrumental in developing the naphtha engine, forerunner of the gasoline motor. When he was 22 years of age Mr. Seabury established his own yacht building company at Nyack, N. Y., to carry on the construction of high speed steam yachts, which later made him world famous. During this period of his career, he produced the Seabury safety watertube boiler which was and still is used where high steam pressures and quick steaming are required. Following this, his business became consolidated with the Gas Engine and Power Company at Morris Heights, N. Y., and for many years he acted as vice-president and general manager of this firm. In addition to yacht work, several torpedo boat destroyers were built at the yard. Under his direction, more than 2,000 yachts have been designed and built, including the *Vitesse, Little Sovereign* and *Sovereign,* the latter having a record speed of 40 miles an hour over the measured mile course. During the war, Mr. Seabury was consulting marine engineer with the Foundation Company at Savannah and New Orleans. For the past three years he has been associated with Carlos de Zafra as a consulting naval architect. Mr. Seabury was a member of the Society of Naval Architects and Marine Engineers and the New York Yacht Club.

Charles L. Seabury

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

The First Quarter

DURING the first three months of 1922 there was reported in the columns of the Weekly Bulletin a total of $34,927,000 in contemplated ship work and $14,930,206 in actual contracts placed, according to figures compiled by MARINE ENGINEERING AND SHIPPING AGE.

Since January 1 of this year the trend of marine activities has been steadily upward both in new vessel construction and the reconditioning of others. Whether or not it is due to the proximity of the expected passage of the Ship Subsidy Bill now awaiting the action of Congress, there is evidence that the second quarter of 1922 will show even more real business activity for ship builders, repair yards, and equipment companies than the first quarter.

Millions of Dollars to Be Spent for the Construction of 22 Ships Which Are Now Well on Way to Contract Stage

Plans of American Shipowners for Business Expansion Indicate Renewed Activity for Shipyards—Programs Contemplated Include Inland and Coastwise Vessels

ACTUAL building operations on the construction of a total of 22 vessels, which will involve the expenditure of many millions of dollars, preliminary announcements concerning which have been previously and exclusively made by MARINE ENGINEERING AND SHIPPING AGE, are expected to begin in the near future, according to latest indications.

FIVE DIESEL BARGES

It is learned that bids have been received and final decision is now under consideration for the placing of a contract for the building of five Diesel-electric propelled barges for the Canal & Rivers Company, 52 Vanderbilt avenue, and designed by R. R. Livingston, marine engineer, of 2 Rector street, New York City.

The boats, which it is expected will cost about $175,000 each, will be 160 feet long with a beam of 36 feet, depth 11 feet 6 inches, and a capacity of 550 tons. Each vessel will be equipped with two Diesel engines driving generators and two motors driving twin propellers. There will be about 280 horsepower in each boat.

THIRTEEN FREIGHTERS

Awarding of a contract for the construction of 13 special type ocean and lake freighters for the Central Steamship & Commerce Corporation, 30 Broad street, announced by MARINE ENGINEERING AND SHIPPING AGE, February 25, 1922, is looked for in the near future. These vessels were designed by Theodore D. Wells, naval architect and marine engineer of 11 Broadway, New York City. They are to be driven by Diesel-electric engines and will be for service through the Welland Canal and New York Barge Canal between New York and Chicago and also to the West Indies when canal traffic is closed.

FOUR PASSENGER SHIPS

Although it is believed it will be several weeks before definite information is available, it is learned that work is being pushed on the preparation of plans and specifications for the two new passenger ships to be built for the Eastern Steamship Company, of Boston, Mass., which are being designed by Theodore E. Ferris, naval architect and marine engineer of 30 Church street, New York City. These boats will cost approximately one million dollars each and are to be about 400 feet in length, driven by double reduction geared turbines turning single screws, with boilers fired by oil burners. They will carry over 700 passengers.

While no official information was given out concerning the new vessels proposed by the Old Dominion Steamship Company, Pier 25, North River, New York, of which Mr. H. B. Walker is president, it is understood that tentative plans will provide an innovation in coastwise passenger and freight service with the establishment of an express route between New York and Norfolk, Va., with at least two ships, each about 400 feet long and capable of making the passage from New York to Norfolk over night.

Philadelphia Marine Exposition

Indications point to the Annual Marine Exposition to be held in the First Regiment Armory, Philadelphia, Pa., from May 8 to 13 inclusive, as one of the most important events of the kind ever held here. More than 100 exhibitors are expected to take part in the affair.

Preliminary Plans Under Way to Recondition the Agamemnon and Mount Vernon

Announcement is made from Washington that the Shipping Board has voted to have W. F. Gibbs, naval architect and marine engineer, of New York, prepare plans and specifications for the reconditioning of the ex-German passenger ships *Agamemnon* and *Mount Vernon*. It is stated that the Board is seriously considering the putting of these ships in service but whether or not the work will be done will depend largely on the estimates of the probable cost.

Proposed Seagoing Dredges Are Receiving Consideration at Washington

Latest developments with regard to the proposed building of six seagoing dredges, at an estimated cost of about $4,500,000, announced in the Weekly Bulletin of February 11, 1922, indicate that the project is receiving the serious attention of the United States Engineer Office at Washington, D. C., and that, according to present plans, four of the six proposed boats will be equipped with Diesel electric machinery. The remaining two will be steam driven.

It is also learned that the Department is working on the preparation of designs for a steam driven dredge of somewhat smaller dimensions than the 247-footers already proposed.

Contract Placed for Construction of River Type Steel Car Ferry

The contract for the construction of a steel side wheel car ferry for use on the Mississippi River has been awarded to the Charles E. Ward Engineering Company of Charleston, West Virginia. The boat is for the Missouri & Illinois Railroad, and was designed by the firm of Cox & Stevens, naval architects, of 25 Broadway, New York City.

The vessel will be 285 feet in length over all, with a beam over guards of 86 feet, and depth of hull 11 feet, draft 5 feet. She will be driven by two simple engines having a diameter of 22 inches and an 8-foot stroke. Steam will be supplied by six river type boilers.

The steamer will be of the three-track ferry type with machinery and boilers on deck. Delivery is scheduled for the latter part of September, 1922.

May Convert Fireboats to Diesel or Gasoline Power

The City of Portland, Ore., C. A. Bigelow, Commissioner of Public Affairs, is investigating the feasibility of converting its oil burning steam fireboats into either Diesel or gasoline equipment.

Federal Shipbuilding Company Awarded Contract for Building of Merchants & Miners Ships

Vessels Are to Be of Combined Passenger and Freight Type for Service on Atlantic Seaboard—Will Be 368 Feet in Length and Equipped with Modern Improvements

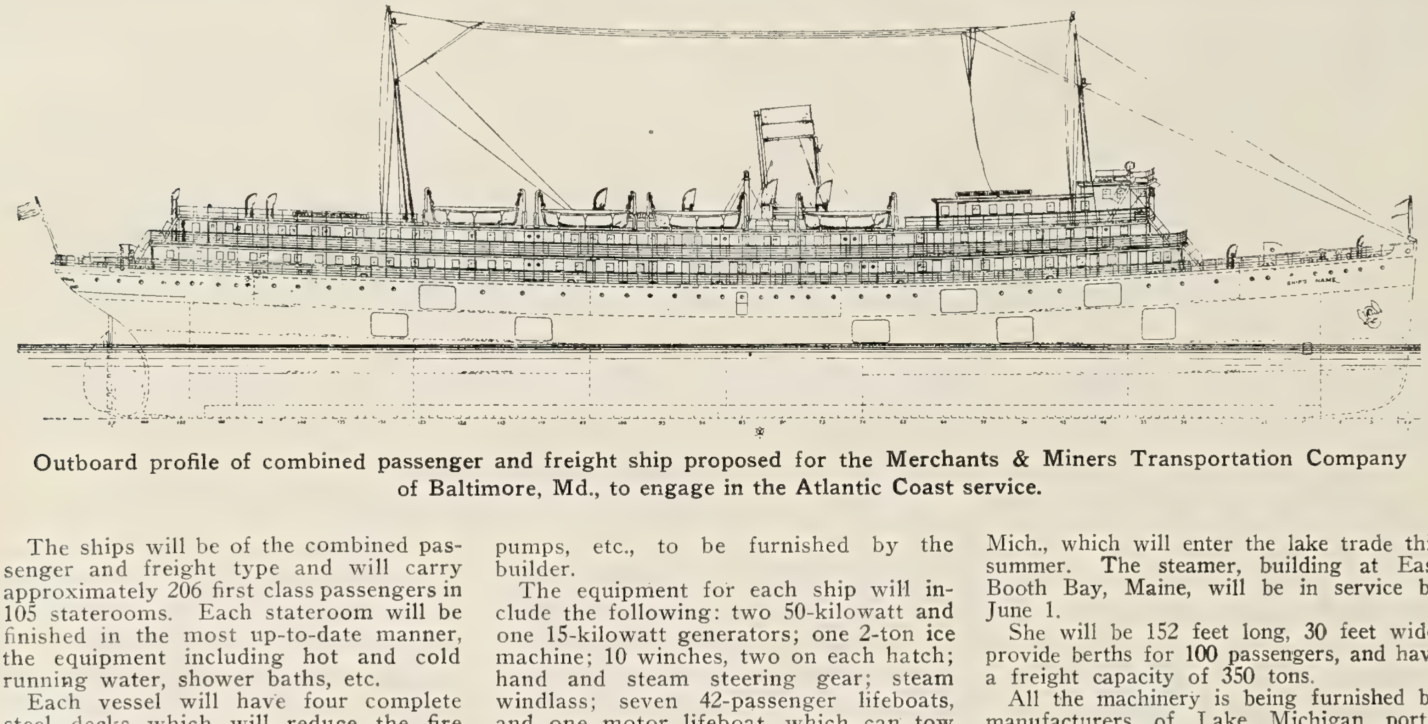
THE Federal Shipbuilding Company of Kearney, New Jersey, has been awarded a contract for the construction of two combination passenger and freight ships for the Merchants and Miners Transportation Company of Baltimore, Maryland. The vessels will be built on the Isherwood system of longitudinal framing.

The type of ship proposed will have an overall length of 368 feet; length between perpendiculars 350 feet; breadth molded 52 feet; depth to hurricane deck 35 feet; depth to main deck 27 feet 3 inches; draft 19 feet; indicated horsepower 2,700; sustained sea speed 12 knots; displacement 7,000 tons.

bulkheads, in accordance with the United States Steamboat Inspection Laws, and the vessels will meet the highest classification of the American Bureau of Shipping. Special attention has been paid to stability and when completed the vessels will be among the safest American passenger ships afloat.

Each ship will be equipped with four, single-ended Scotch boilers equipped with Howden forced draft; oil burners; superheaters and Diamond soot blowers.

The propelling machinery will consist of four cylinder, triple expansion engines developing 2,700 horsepower, the auxiliary machinery including condensers,



Outboard profile of combined passenger and freight ship proposed for the Merchants & Miners Transportation Company of Baltimore, Md., to engage in the Atlantic Coast service.

The ships will be of the combined passenger and freight type and will carry approximately 206 first class passengers in 105 staterooms. Each stateroom will be finished in the most up-to-date manner, the equipment including hot and cold running water, shower baths, etc.

Each vessel will have four complete steel decks which will reduce the fire hazard to a minimum. A system of mechanical ventilation will be installed assuring an adequate supply of fresh air in the staterooms. There will also be

pumps, etc., to be furnished by the builder.

The equipment for each ship will include the following: two 50-kilowatt and one 15-kilowatt generators; one 2-ton ice machine; 10 winches, two on each hatch; hand and steam steering gear; steam windlass; seven 42-passenger lifeboats, and one motor lifeboat, which can tow the others.

The vessels, when completed, are to run between Baltimore or Philadelphia and Savannah or Jacksonville.

Million Dollars Worth of Business Placed with Order for Construction of Three Steel River Type Steamers

THE Louisville & Cincinnati Packet Company has contracted with the Midland Barge Company, of Pittsburgh, for three large side-wheel steel steamers, which it is expected will cost close to $300,000 each.

One steamer, which will be named the *America,* will be used for excursion purposes. This vessel will be 285 feet long with 45 feet beam. She will be equipped with the Mississippi River type of boilers and high pressure, non-condensing engines.

The other two vessels, which will be combined passenger and freight boats, will have a length of 300 feet and a beam of 45 feet. They will be placed on a regular run between Cincinnati and Louisville and will have stateroom accommodations for 175 passengers. It is expected these vessels will make the run of 131 miles between Louisville and Cincinnati in six hours.

Steam will be generated in eight flue boilers. It has not been decided whether single engines of 30-inch diameter and 10-foot stroke or compound engines will be used.

Great Lakes Plant Gets Contract for Construction of 605 Foot Freighter

The Wilson Transit Company of Cleveland, Ohio, has placed an order with the Great Lakes Engineering Works, of Ecorse, Michigan, for a bulk freighter of the arch type construction. The vessel is to be 605 feet over all length, with 60 feet beam and 32 feet molded depth. She will be driven by a triple expansion engine with cylinders 34½, 40 and 65 inches diameter and 42-inch stroke.

Steam will be supplied by three Scotch boilers, 11 feet by 13 feet 6 inches. The ship will carry 12,500 long tons on 20-foot draft. Delivery is scheduled for the middle of September.

New Steamer Contracted for by Benton Transit Company for Lake Trade

The Chicago Steamer Exchange has contracted for a new steamship for the Benton Transit Company, of Benton Harbor, Mich., which will enter the lake trade this summer. The steamer, building at East Booth Bay, Maine, will be in service by June 1.

She will be 152 feet long, 30 feet wide, provide berths for 100 passengers, and have a freight capacity of 350 tons.

All the machinery is being furnished by manufacturers of Lake Michigan ports. The boat will have a steel turtle-shaped deck forward and command the lowest insurance rate.

Babcock & Wilcox Company Earns $9.29 a Share in 1921

The annual report of the Babcock & Wilcox Company, for 1921, shows net income after charges, Federal taxes and inventory adjustments of $1,394,589, equivalent to $9.29 a share earned on the 15,000 shares of capital stock outstanding, compared with net income of $2,207,803, or at the rate of $14.71 a share in the preceding year.

Gross profit totaled $2,101,061, against $4,281,866 in 1920.

Construction of Ten to Fifteen Self Propelled Oil Carriers for South American Service Contemplated

Four to Six Million Dollars May Be Expended for Special Type of Steel Ship—Preparation of Plans Believed to Be in Preliminary Stages

THE possibility of the placing of an order for the construction of from 10 to 15 self-propelled steel oil tankers of a specialized type, at a total cost which it is believed will range from four to six million dollars, is the latest new ship construction prospect for 1922, according to information obtained by MARINE ENGINEERING AND SHIPPING AGE.

It is learned that the New England Oil Refining Company, 25 Broadway, New York City, is contemplating the construction of such boats for service between Maracaibo Lake and other Venezuelan ports and possibly Tampico or other oil centers of Mexico. While no definite or detailed information was obtainable with regard to the present status of these contemplated ships, it is reported that a prominent New York naval architect has been consulted with a view to preparing tentative plans of a type of vessel suitable for such service.

It is thought that the proposed carriers will be about 350 feet in length and to meet the requirements they would probably have a draft of 10 or 11 feet in order to make the passage to and from Maracaibo Lake. The propelling machinery will very likely consist of internal combustion engines developing from approximately 800 to 1,000 horsepower, giving the vessels a speed of 8 or 9 knots.

Many Contracts Being Placed for Leviathan Equipment

The work of reconditioning the steamship *Leviathan*, which will involve a total expenditure of $8,200,000, is well under way at the plant of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va.

Among the contracts for materials and equipment, which have been placed by the shipbuilding company in conjunction with the *Leviathan* contract, the following are included to date:

For steel plates and shapes, gyro compass equipment, insulated safety wire, copper pipe, main electric generator, tubes for auxiliary condenser, aero fire alarm system, monel metal bars, brackets, fans, air pressure gauge, forged steel flanges, torsion meters, tubes for drainage condenser, fuel oil meters, forced draft blowers, hardware, electric lighting fixtures, electric clock cases, plumbing fixtures, fire hose, fuel oil burners, pumps, donkey boiler, and iron and steel pipe.

City of Tampa, Fla., to Vote May 23 on $600,000 Port Bonds

The ordinance officially calling a city election for May 23, for voting on $600,000 bonds for completion of the municipal port terminals, has been passed by the city commission of Tampa, Fla. The ordinance provides for the issuance and sale of bonds, for the expenditure and disbursing of the funds from the sale of the bonds, and calls the election to authorize the same. It provides that when sold, the money be used for building municipal docks or wharves, railroad tracks, warehouses, etc., on the west side of the Ybor estuary, and any money left shall be used only for further improvement and development of the harbor, and the city's waterfront property.

City Manager Hall's estimates include the following: Two thousand four hundred thirty-five lineal feet concrete docks and bulkhead at $175 per foot, $426,125; freight warehouse, one-story, $70,000; cranes, trucks, etc., for loading and unloading, $40,000; water supply, office building and other expense, $30,000; total, $566,125.

Aberthaw Construction Company Gets $271,416 Job on Portland Pier

The contract for the construction of the substructure of the State pier at Portland, Me., was awarded on March 10 to the Aberthaw Construction Co., of Chelsea, Mass., on the company's tender of a price of $271,416.75.

Initial development calls for a pier 1,000 feet in length, 144 feet in width at its outer end, 236 feet in width at its inner end with the dock between the proposed pier and Atlantic Wharf to be 250 feet in width. The berth adjoining the pier will be dredged to a depth of 35 feet at mean low water for a width of 125 feet and the berth adjoining the Atlantic Wharf to a depth of 30 feet, gradually deepening to 35 feet at the property line. The plans and specifications were prepared by Fay, Spofford and Thorndike, of Boston, Mass., consulting engineers.

It is expected that the pier will be in operation early in 1923.

Creole Awarded to Robins Plant for Reconditioning

The contract for the reconditioning and conversion of the Southern Pacific steamship *Creole* from coal to oil burning was forwarded on April 11 to the Robins plant of the Todd Shipyards Corporation, Brooklyn, N. Y. Besides the conversion of the fuel system the work includes the rearrangement of boilers, reconditioning of passenger accommodations and the building of additional passenger quarters at a total cost of close to $200,000.

Big Dredging Job Proposed for Delaware River

United States Engineer Office, Room 815 Witherspoon Building, Philadelphia, will receive sealed proposals until 12 o'clock noon, May 18, for dredging in the Delaware River on the Liston Range.

The work to be done consists of the construction of a channel having a least bottom width of 800 feet, a least depth of 35 feet at mean low water and a length of approximately 7,000 feet. The estimated quantity of material to be removed, including allowable overdepth, is 1,476,600 cubic yards, scow measurement.

Baltimore to Spend $50,000,000 For Development of Its Port Facilities; $10,000,000 of Fund Authorized

THE Port Development Commission of Baltimore, Maryland, after several months' work, has made public the tentative plans for the proposed development of the Baltimore port. The total port loan amounts to a sum of $50,000,000.

The Public Improvement Commission now has $2,200,000 available for immediate use in the development of the harbor. With the cooperation of the Improvement Commission, the Port Commission will have the use of this sum at its command. Ten million dollars of the total sum of $50,000,000 has already been authorized and as soon as leases are made will be available. When the leases are made a part of this loan can be used to replace amounts advanced by the Public Improvement Commission. Thus a revolving fund will be kept intact for working capital and the Port Commission would be able to immediately begin the improvements in accordance with the plans.

TENTATIVE PLANS

At the northern extremity of the bulkhead will be a long marginal wharf and south of this a series of five piers.

Tentative developments for the eastern side of the harbor show eight piers on the Canton Company's property, but the policy of the commission is to expend its principal efforts on the western side of the river. If lessees should be found for piers on the Canton Company's property, piers will be built in accordance with the layout plans, after the property for them is acquired by the city.

The city owns a big block of property on McComas Street and it is proposed to concentrate there first. Other property will have to be acquired in order to carry out the commission's plan. All the waterfront on the south side of Locust Point, from the Western Maryland piers at Port Covington to Fort McHenry, will be required for the carrying out of the McComas Street project. Practically two whole blocks of this site are owned by the Baltimore and Ohio and the Bethlehem Shipbuilding Corporation, Bethlemem, Pa.

PATAPSCO DEVELOPMENT

It will be necessary to confine the channel of the Patapsco River where it overflows the mud islands and flats to the south shore and also to acquire property owned by Arundel Corporation or compensate them for practical loss of waterfrontage, in order to carry out the plan for the Patapsco group on the mud islands behind Hanover Street bridge and the proposed fill in front of the bridge. The layout as planned cuts off the Arundel property entirely from development for pier purposes.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Ship Purchase, Seattle, Wash.—Alaska Steamship Company, Seattle, Wash., is in the market for purchase of a passenger and freight ship for service between Seattle and Alaskan ports. Intention to build apparently abandoned. Three thousand ton ship probably needed.

Repair Contract, New Orleans, La.—Repairs to damage to Standard Oil Company's tanker Pioneer, caused by collision with seawall at Tampa, Fla., awarded Jahncke Dry Dock Company, New Orleans. Repairs: Installing new stem, fairing of vessel's forefoot, renewing 24 plates on bow, drydocking and painting.

Fireboat, West Coast.—New York naval architect understood to be preparing tentative plans and specifications for fireboat for a city on west coast. It is believed proposed boat will be about 125 feet long with Diesel engines, 600 indicated horsepower, and capacity of 10,000 gallons per minute. Estimated cost is $300,000.

New Ferry, New York.—Report in New York marine circles that West Shore Railroad is considering construction of new ferryboat developed that while new boat had been contemplated time of definite action is not certain.

Steel Ferry, British Columbia.—Canadian National Railways Grand Trunk Pacific Dry Dock, Prince Rupert, B. C., reported as having secured order from British Columbia Public Works for steel ferry to operate on Francois Lake about 250 miles inland along Grand Trunk Pacific Railway, boat to be fabricated and assembled at plant and shipped to lake for completion. Contract includes construction of wooden cradle to be built on marine ways and installed by Public Works Department.

New Ship, Welland, Ont.—Collingwood Shipbuilding Company, Collingwood, Ont., received order from National Sand & Materials Company of Welland, Ont., of which David Dick, Jr., is president, for special type steamship for securing and carrying sand and gravel. The vessel will be about 258 feet long, deadweight carrying capacity of 3,000 tons, single screw, driven by triple expansion surface condensing steam engine with two boilers having 180 pounds working pressure.

Oil Burner, Los Angeles, Cal.—Clyde's sailing ship Falls, formerly operated by the Matson Navigation Company, in run from San Francisco to Philippines and Hawaii, will be converted into oil barge, operating out of Los Angeles harbor.

Recondition Steamers, San Francisco, Cal.—Thomas L. Wand and Wellesley, steam schooners purchased by John C. Ogden, to be reconditioned at San Francisco, will probably be equipped with Diesel engines and other changes made before they are placed in coastwise lumber trade.

Construction Contract, New York.—Tebo yacht plant of Todd Shipyards Corporation was awarded contract for construction of steel Diesel-engined yacht to be built to designs of Cox & Stevens for Merrill B. Mills, of Detroit. Dimensions: 129 feet over all length, 23 feet beam; two Diesel type, six-cylinder, four-cycle Winton engines, each developing 225 brake horsepower.

Pile Driver Hull, Tampa, Fla.—The Tampa Shipbuilding and Engineering Company of Tampa, Fla., with price of $4,500, was low bidder for pile driver hull for United States District Engineer office at Montgomery, Ala., at opening of bids in that office on March 20.

Construction Contract, Wilmington, Del.—The Bethlehem Shipbuilding Corporation, Ltd., was awarded the contract for construction of an ocean-going auxiliary yacht for Keith Spalding, of Chicago. Delivery scheduled for first of October, 1922; vessel 161 feet long, designed by Henry J. Gielow, Inc.

Fireboat Conversion, Portland, Ore.—City of Portland, Ore., C. A. Bigelow, Commissioner of Public Affairs, is investigating feasibility of converting its oil burning steam fireboats into Diesel or gasoline equipment. City maintains two fireboats: one, 125 feet long, capacity of 9,000 gallons per minute; the other, 115 feet long, capacity, 6,000 gallons per minute.

Contract Award, New York.—G. E. Engineering Company, 449 West 42nd St., New York, was awarded contract for steam supply system, specification 4586—Bureau Yards and Docks, Navy Department, Washington, D. C., price $168,300 (150 days) less $86,100 (30 days), item 6 (deduction made if two 250 horsepower boilers are furnished by Government), making total award of $71,300 (120 days).

Diesel Engine Installation.—Announcement made from Seattle that Pioneer Towing Company, engaged in Puget Sound—British Columbia, towing for years and now enlarging operations in Sound log towing industry, has converted one of its tugs into Diesel-powered vessel and will make similar installation in another boat of same type.

Construction Contract, West Virginia.—Contract for construction of steel side wheel car ferry for use on Mississippi River awarded to Charles E. Ward Engineering Company, of Charleston, W. Va. Boat is for Missouri & Illinois Railroad, designed by Cox & Stevens, naval architects, 25 Broadway, New York. Dimensions, 285 feet long, beam 86 feet, draft 5 feet.

Seagoing Dredges.—Latest developments regarding proposed building of six seagoing dredges, estimated cost $4,500,000, indicate the project is receiving serious attention of United States Engineer Office, Washington, D. C., and according to present plans, four of six proposed boats will be equipped with Diesel electric machinery, remaining two to be steam driven. Department also working on preparation of designs for steam driven dredge of somewhat smaller dimensions than 247-footers already proposed.

Repair Contract Award, New Orleans, La.—F. W. Hooley Iron Works, New Orleans, awarded contract for repairs to Shipping Board steamer Youngstown.

Contract Awards, New Orleans, La.—Johnson Iron Works, Dry Dock & Shipbuilding Company, Inc., New Orleans, La., was awarded three jobs for repairing and general overhauling on steamships Tegucigalpa, Ceiba and Yoro, of Vacarro Bros. & Company Lines. All three vessels were docked, scraped, painted, tail shafts drawn, and pintles examined, along with numerous other repairs.

Coastwise Towing Job.—W. G. Coyle Towing Company of New Orleans, La., contracted with J. W. Sullivan of New York, to tow from New Orleans to Jacksonville, Fla., Ferris type wooden ship Abergfoil, to be converted into barge. The new ocean going tug DeBardelebem, formerly Bartherry, was scheduled for towing job. Same company reported as engaging with Sullivan concern to tow the steel barge Nashville from New Orleans to New York, to be used in Long Island Sound service.

Reversing Rudder Installation, Bridgeport, Conn.—McNab Company of Bridgeport, Conn., delivered to Hildebrant Dry Dock Company, South Rondout, N. Y., one of their Kitchen's Patent Reversing Rudders, measuring 66 inches by 77 inches, for installation on 70-foot tow boat building at Hildebrant yard to order of Transmarine Corporation. The tow boat will be driven by 170 brake horsepower Nelseco Diesel, six-cylinder submarine engine, non-reverse type.

Possible Construction of Oil Carriers, New York.—New England Oil Refining Company, 25 Broadway, New York, contemplating construction of from 10 to 15 self-propelled steel oil tankers of specialized type, total cost ranging from four to six million dollars. Dimensions: 350 feet long and probably a draft of 10 or 11 feet.

Contract Award, New York.—Bethlehem Shipbuilding Corporation, with bid of $157,680, awarded contract for reconditioning steamship Granite State for service in United States Lines. Contract provides increasing cabin accommodations, installation of accommodations for about 400 third-class passengers in rooms.

To Construct Steel Barge, Algiers, La.—Johnson Iron Works, Algiers, La., awarded contract for construction of all steel oil barge for Southern Paper Mills Corporation, Moss Point, Miss. Dimensions: 144 feet long, 32 feet beam.

Ship Construction, Boston, Mass.—It is learned that the North Atlantic & Western Steamship Company, Boston, Mass. (Nawsco Line), contemplates addition of six motorships to fleet, type similar to American motorship William Penn, apparently held in high favor.

Possible Construction.—Old Dominion Steamship Company is said to be considering building two new passenger and freight ships, coastwise type.

Repair Contract, Mobile, Ala.—Alabama Dry Dock Company awarded steamship Bayo Chicago repairs, work consisting of repairing bow damaged in collision with steamship Antinous. Also awarded contract for repairs on steamship Trinidadian, tanker of Gulf Refining Company.

Contract Awards, Hoboken, N. J.—W. & A. Fletcher Company, Hoboken, N. J., awarded contracts for Eastern Craig, Benjamin Brewster, San Pablo and Sixaolo, drydocking and various repairs. Total about $7,900.

Shipping Board Contracts.—Steamers McKeesport and Bremerton awarded Federal Shipbuilding Company for repairs; McKeesport, $7,899, and Bremerton, $6,238.

Keel Laying, Alameda, Cal.—Alameda plant of Bethlehem Shipbuilding Corporation laid keel for 20,000-ton ore carrier, April 15, beginning of work on first of two steamers on West Coast.

Contract Awards.—Bethlehem Shipbuilding Corporation awarded steamer Eastern Sea, $6,097; Chappaqua, $1,246. Curtis Bay Copper and Iron Company also received award from Shipping Board of the West Gotomska for repairs, at $7,377.

Motor Craft.—Six 50-foot motorboats being built at Navy Yard, Norfolk, Va., competition with Mare Island, probably be completed by July 1, contingent on promptness of delivery of five engines from Portsmouth, N. H. Engine for one of boats arrived and wood necessary in construction of boats received from New York. Receipt makes possible trying out of first boat at early date. Probable cost of boats, $16,000 each.

Steamship to Be Repaired.—The Mazama, damaged by Lewis Luckenbach, drydocked at Sun Shipyard for miscellaneous repairs.

To Be Reconditioned.—Shipping Board steamship Egremont, laid up some time, taken over by Kerr Steamship Company, now at Newport News Shipbuilding and Dry Dock Company's yards for repairs. Upon completion, soon, to be taken to New York and placed in service between that port, Norfolk, and India.

Repair Contract.—Contract for repairs to steamer Heffron awarded by Shipping Board to Robins Dry Dock & Repair Co., price $11,000.

SHIPYARDS AND DRY DOCKS

Shipyard Sold.—Maryland Dry Dock Company took over operation of plant of Globe Shipbuilding and Dry Dock Company, April 1.

Shipyard Restored.—Winnisimmet Marine Railway and Shipyard restored to activity after period of idleness, with hauling out of Ransom B. Fuller, of Eastern Steamship Lines. Winnisimmet yard, one of marine projects of war, situated on Marginal St., Chelsea, Mass., Railway, built at cost of $600,000, can haul large draft ships.

Shipyard Bought.—Plant of Beaumont Dry Dock and Shipbuilding Co., one of largest in Texas, purchased by Petroleum Iron Works Co. New owners to transform plant into one for building fabricated vessels, steel oil tanks and railroad rolling stock, probable actual operation this month. Plant erected during war, turned out many vessels during that time. Complete in every detail, considered one of largest plants of kind in that section of country. Petroleum Iron Works Co. will enlarge plant, make other improvements not in deal. Said that company has contracts already for hundreds tons of steel for steel tanks in this country and Mexico.

PORT IMPROVEMENTS

Seawall, Anona, Fla.—Contract for constructing seawall at Haven Beach awarded to A. T. Le Vasconte.

Pier, Biloxi, Miss.—Plans submitted to Chamber of Commerce for building amusement pier; J. H. Etter interested in building.

River Terminals, Memphis.—City plans construction of river terminals and warehouse. Issue $150,000 bonds. Address Rowlett Paine, mayor.

Harbor Development.—Broward County Commissioners, Fort Lauderdale, Fla., to construct ocean inlet, deepen local harbor, $100,000 bonds voted.

Inlet, Jetties, Etc.—Jupiter Inlet, District Palm Beach County, Fla., to construct inlet, jetties, deepen water way; approximate cost $80,000 to $100,000.

Seawall, West Palm Beach, Fla.—D. E. O'Hara received contract from Palm Beach Company, $30,000, to construct concrete seawall at El Cid, C. H. Ruggles, engineer.

Levee.—Four mile levee to protect Carter Lake District and East Omaha land, planned by Pottawattami County, Ia. (Council Bluffs), and Douglas County, Neb. (Omaha), $175,000.

Seawall.—Contract awarded Burns Dredging Co., Sarasota, Fla., to build 3,700 foot seawall around Cedar Point, reclaiming 22 acres; approximate cost of seawall $50,000, dredging $26,000.

Wharves.—City of Orange, Tex., has sold $240,000 bond issue for construction of 800 feet additional wharves, modern warehouses, and various other improvements. Address the mayor.

Loading Facilities.—Humble Oil & Refining Co., Houston, Tex., reported planning construction of loading station, skeleton wharves, and probably two storage tanks at mouth of Neches River, Texas.

Levee.—Red River, Atchafayala and Bayou Boueff Levee Board awarded contract to H. Devill & Co., Marksville, Miss., to construct 57,000 cubic yards levee in island district between Alexandria and Boyce, price $13,000.

Wharf Dock.—Contract awarded by District Commissioners, 509 District Building, Washington, D. C., to Cambridge Manufacturing Company, Cambridge, Maryland, for wharf dock at Water St., between M and N streets, price $14,260.

Harbor Improvements, Houston, Tex.—Thomas H. Ball, chairman of Harbor Board, reports $1,000,000 may be available next 12 months for ship channel development; project calling for 10-foot channel, 60 feet wide from turning basin to foot of Main street.

Contract Award.—Contract for pile foundations of new Norfolk grain elevator awarded by City Port Commission to Sanford & Brooks, Norfolk, price $92,941.30. Foundation will require nearly 3,000 piles; includes in specifications cofferdam, $14,000, and excavating expense, $12,500.

Levee, Clarksdale, Miss.—Proposed construction of 21 miles of levee, extending from Brunswick to point opposite Vicksburg, approved by Yazoo Mississippi Delta Levee Commissioners; estimated cost $1,500,000, reclaiming about 250,000 acres land in Sharkey, Holmes, Leflore, Yazoo and Humphrey counties.

Pier Contract Award.—City of Philadelphia, Department of Wharves, Docks and Ferries, awarded contract for construction, with appurtenant work, of superstructure, Porter Street Pier, No. 84 South Delaware River, to Franklin M. Harris & Co., 1518 Parrish St., Philadelphia, Pa., price $1,674,515. Superstructure to be two-story steel and reinforced concrete structure.

Warehouse and Superstructure, Havana, Cuba.—Havana Docks Corporation, Havana, Cuba, awarded Turner Construction Company, 224 Madison Ave., New York, contract for construction of 5-story warehouse and 2-story superstructure on pier in Havana harbor. Pier is 580 feet long and job runs into several millions of dollars.

Dredging, Delaware River.—United States Engineer Office, Room 815, Witherspoon Building, Philadelphia, to receive sealed proposals until 12 o'clock noon, May 18, for dredging in Delaware River on Liston Range. Work consists of construction of channel having least bottom width 800 feet, least depth 35 feet at mean low water and a length approximately 7,000 feet. Estimated quantity of material to be removed, including allowable overdepth, is 1,476,000 cubic yards, scow measurement.

Harbor Improvement, Beverly, Mass.—Beverly, Mass., to get $98,000 additional in schedule for new river and harbor improvements for widening and deepening the channel and improving harbor conditions. Schedule calls for estimated expenditure of approximately $31,100,000 authorized under bill ordered reported by House Rivers and Harbors Committee in Congress. Bill provides only for new projects and, if enacted, would require subsequent passage of appropriation bill providing funds for various projects. Besides the Government appropriation, city has already appropriated $25,000 and State has made $50,000 available for work.

NEW INCORPORATIONS

It is reported from Richmond, Va., that the Newport News Shipbuilding and Drydock Company has increased its capital from $12,000,000 to $26,000,000.

Ocean Carriers Co., Manhattan, $35,000; J. L. Watson, F. H. Butehorn, T. E. Halle (attorney, F. J. Knorr, Albany).

Florida Dredging Company, Miami, Fla., capital $75,000; C. L. Crandall, president, B. K. Crowell, secretary and treasurer.

A. D. N. Steamship Corp., Manhattan, $15,000; R. J. Sykes, M. Roger, W. H. Gillon (attorney, P. Boyninge, 111 Broadway).

Gore & Hanley, Manhattan, navigation, $5,000; A. G. Gore, W. Hanley, W. Ostrander (attorney, P. Baumer, 15 Whitehall St.).

Megathlin & Clark Dredging Co., Miami, Fla., capital $50,000; J. L. Megathlin, president, J. T. Rambler, secretary and treasurer.

Murray Harbor Transportation Co., Brooklyn, $150,000; J. J. Murray, T. J. Boyce, J. D. Carroll (attorney, J. P. Carroll, 189 Montague St., Brooklyn).

Gladding Express Co., Steamship Line, Baltimore, Md., Pier 4, Light St., increased capital to $100,000; establish steamer service between Baltimore and Cambridge.

Nidaros Steamship Company, 605 Water St., Baltimore, Md., capital $200,000; E. Garrett Atkinson, 105 Singer Ave., August Olsen and O. Legard Jones, incorporators.

Consolidated Fuel Company of New Orleans, La., organized for purpose of bunkering ocean-going ships and tow boats. Company will have following officers: H. C. McCormack, president; Robert P. Hyans, vice-president; H. C. Whiteman, vice-president, and Charles Harrington, sales manager.

Floridian Trading Corp., Steamship Line, Jacksonville, Fla., capital $150,000, chartered with Emory C. Meek, president; F. I. Maynard, secretary; E. K. Sharlow, treasurer; steamship lines to Havana, Cuba, Porto Rico and Venezuela ports.

FOREIGN ACTIVITIES

Launching of Steamer, Hamburg.—Built for the Deutsche-Australische Dampfschiffs Gesellschaft, steamer Cassel, 9,000 tons, has been launched from Kockum shipyard at Malmo.

Motor Shipbuilding in 1921, Holland.—Of total of about 500 large and small craft built in Holland during 1921, nearly 70 vessels under 500 tons were propelled by internal-combustion machinery.

Order for Ten Steamers, Russia.—Russian Soviet Government has given order to newly opened Anglo-Baltic Shipbuilding and Engineering Company, at Reval, for ten steamers, work to begin at once.

Order for Floating Dock, Rotterdam.—The Rotterdamsche Droogdock Maatschappij has placed order with Burgerhout Engineering and Shipbuilding Co., Rotterdam, for construction of 8,000-ton floating dock.

Delivery of Tugboat, Rotterdam.—Tugboat Schiedam, built by Messrs. J. and K. Smit, at Kinderdijk, Holland, for Messrs. L. Smit and Co.'s Sleepdienst, Rotterdam, just delivered to owners. Fitted to burn oil fuel or coal, the vessel has a length of 71 feet, breadth of 19 feet, and depth of 9 feet 9 inches.

Proposed Ship Construction, Australia.—The State Government of Western Australia propose construction of Diesel engined ships of 4,000 tons for conveyance of approximately 2,500 tons of frozen meat in addition to other cargo and approximately 175 passengers. Vessels to be built in Scotland, but probably not until headway is made with scheme to establish new harbor and rail center on King's Sound, Western Australia.

Ship Completion Work, Belgium.—Work resumed on Red Star passenger liner Belgenland, designed for Antwerp trade, passenger capacity of 3,000, to register 26,000 tons. She is largest ship to ply in Belgian waters. At time of war she was turned into transport with no passenger accommodations. Her maiden voyage is contemplated in spring, 1923. Built by Harland & Wolff, the ship is 670 feet long, 75 feet wide, speed 18 knots.

Biggest Motorship Proposed, Germany.—In addition to 9,000-ton cargo vessel now being built for North German Lloyd's, equipped with machinery of 3,200 horsepower, Norddeutscher Lloyd have under consideration construction of intermediate cargo ship, 9,000 tons gross, with speed of 12½ knots. The ship would perhaps be largest motor passenger liner in world, although Scandinavian-American Line intends to build an 18,000-ton ship of this class when circumstances become more propitious.

Ship Construction, Sweden.—Approximately 55,000 tons of shipping were launched from Swedish shipyards during 1921, increase of 12,000 tons over previous year. On Jan. 1, 1920, vessels totalling over 100,000 tons were under construction. Motor ship rapidly gaining ground, however, in Scandinavia, no less than 42,530 tons of ships now nearing completion being of this type, compared with 12,220 tons of steamships. Total tonnage, Swedish mercantile marine, January 1 this year, estimated 1,090,000 tons, about 1.73 per cent of world's merchant shipping, decline of 55 per cent from 1914 figures.

May Build Six Vessels, England.—Anglo-Saxon Petroleum Co., London, has invited tenders for construction of one, three, and six motor vessels, 2,800 tons deadweight, 270 feet long, 46 feet 6 inches wide, 23 feet deep, and 17 foot draft, speed 10¾ knots. To be constructed for carriage of refined cargoes, propelled by single six-cylinder four-cycle Diesel engines. Deck auxiliaries and steering engine to be steam driven; large donkey boiler fitted in engine-room. Two steam driven cargo pumps, large size to be installed, and 8 inch double pipe lines fitted throughout cargo tanks.

Steamer Launching, England.—The Northumberland Shipbuilding Co., Ltd., launched from their shipyard at Howdon-on-Tyne the steamer Eastmoor, building to order of Messrs. Moor Line, Limited (Messrs. Walter Runciman & Co., Ltd.), Newcastle-on-Tyne, Thursday, March 30. She is shelter deck type, 415 feet long, 53 feet wide, 35½ feet molded depth, carrying about 9,250 tons deadweight on 26 feet 3 inches draft, built to Lloyd's highest class. Propelling machinery supplied by North Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, consisting of set of triple expansion engines, three boilers of 180 pounds working pressure.

Philadelphia Pier Contracts Awarded Harris Company on Bid of $1,674,515

The City of Philadelphia, Department of Wharves, Docks and Ferries, has awarded the contract for the construction, with appurtenant work, of the superstructure of Porter Street Pier, No. 84 South, Delaware River, to Franklin M. Harris & Company, 1518 Parrish St., Philadelphia, Pa., at a price of $1,674,515. The superstructure will be a two-story steel and reinforced concrete structure. The contract was awarded on March 27, bids being as follows:

Franklin M. Harris & Company, Philadelphia, Pa.	$1,674,515
J. S. Rogers Company, Philadelphia, Pa.	1,730,400
Triest Contracting Corporation, New York City	1,794,080
Hughes - Foulkrod, Philadelphia, Pa.	1,798,450
Frederick Snare Corporation, Philadelphia, Pa.	1,828,400

BUSINESS NOTES

The Air Reduction Sales Co., New York, recently acquired all the assets including the patents, trade marks, and trade names of the Davis-Bournonville Co., Jersey City, N. J. The consolidation brings together two large companies, whose histories have, to a great extent, been the history of the development of the oxy-acetylene welding and cutting industry. The Air Reduction Sales Company is a pioneer in the extraction of gases from the air for industrial use. The Davis-Bournonville Company was organized in 1907. The equipment in the future will be marketed under the trade name of Airco-Davis-Bournonville.

Calvin P. Moon, who has been actively engaged in the shipbuilding industry on the Atlantic seaboard and abroad for many years, has established an office in the Cunard Building, 25 Broadway, New York City, to engage in the business of marine engineering, reports, surveys, and designs for ships.

The firm of Wunsch & TerKuile, recently organized, has an office and warehouse at 302-4 McDougal Street, Brooklyn, N. Y. This organization is a co-partnership of Messrs. J. W. Wunsch and C. V. TerKuile and will act as the selling agents for manufacturers of material-handling machinery and marine equipment.

The Marine Decking & Supply Company has removed its New York office from 44 Water Street to 3 Coenties Slip. Mr. A. B. Jewell is in charge of the New York territory on the tackle block division.

STEAMSHIP INTERESTS

The *Maryland*, built at the Tebo plant of Todd Shipyards Corporation for account of Maryland Pilots' Association, assigned to Cape Henry, Maryland, Station. Trial trip very successful. Vessel has berths for 15 pilots, and left New York for Baltimore on April 12.

Ocean Carriers' Co., Inc., 25 Beaver St., New York, announced new freight service, New York to Portugal and Spain, with fleet of chartered steamships. Service inaugurated April 25, followed by other vessels at regular intervals.

Australia will resume trade with Germany on August 1, ending period of seven years during which embargo on trade with enemy countries was enforced.

Beginning this month monthly cargo service to South and East African ports will be inaugurated. New service under management of Mallory Steamship Lines, Inc., only American line operating on route, and will involve placing six vessels on route. Calls to be made at Cape Town, Port Elizabeth, East London, Durban, Beira and possibly Zanzibar and Mombasa.

TRADE PUBLICATIONS

Safety Hand Lamp.—A patent electric safety hand lamp, suitable for use in any danger zone, as aboard oil tankers, is described in a bulletin issued by Watts, Fincham & Company, Ltd., Billiter Building, 22 Billiter St., London, E. C. 3, England. The lamp is gas and watertight and has been approved by Lloyd's Registry of Shipping.

Oil Storage.—The recent issue of *The Atlantic Lubricator,* published by the Atlantic Refining Company, Philadelphia, Pa., contains an illustrated feature article on the design, construction and erection of steel oil storage tanks as well as a number of articles dealing with lubricating and oil producing problems.

Hand Cut Files.—A catalogue listing the various type quality files produced by Murcott & Campbell, Inc., Brooklyn, N. Y., is being distributed. Standard types of pillar and flat files, mill saw files, square and round files, half round, etc., with illustrations and details of numerous special types are given together with sizes and prices. The various "cuts" in general use, as rough, bastard, second cut, smooth, dead smooth and the like are described for the information of those desiring to adopt files best suited to their requirements. Sections of files used to the greatest extent are also shown

London Steam Turbine.—For driving boiler feed pumps and standard types of centrifugal machinery, the London steam turbine has been developed in two bearing units. The application and advantages of this system of drive have been described in a preliminary folder distributed by the London Steam Turbine Company, Troy, N. Y. Complete details of the equipment will be given in a new catalogue which will be published within a short time.

Evaporators for Boiler Feed Water.—The application of evaporators to the purification of boiler feed water by distillation is covered in a general and non-technical manner in bulletin No. 360 now being distributed by the Griscom-Russell Company, New York. This booklet is so written that the application of Reilly self-scaling evaporators to the power plant for the elimination of scale, blow-down, priming, and the like may be readily understood by the executive as well as the engineer.

Export Helps.—The Department of Commerce, Bureau of Foreign and Domestic Commerce, has issued a booklet outlining the organization and purpose of the new industrial machinery division of the bureau. Every manufacturer who has surplus products which can be exported is recommended to use the service of the new division in extending his foreign business. The research work of the division is extensive and as time goes on will be the source of practically any information that may be required of the selling possibilities of all manner of machine products in the world market.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander J. S. Evans, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia
Via Carlo Alberto 18, Genova.

Marine Engineering
and Shipping Age

Volume XXVII June, 1922 Number 6

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
S. M. PHILLIPS, Associate Editor L. S. BLODGETT, Associate Editor
W. Z. GARDNER, News Editor

Contributing Editors

Rear Admiral C. W. Dyson, U. S. N.
Commander S. M. Robinson, U. S. N.
Professor C. H. Peabody
Captain C. A. McAllister, U.S.C.G. (Retired)
William Gatewood
H. McL. Harding
William T. Donnelly
James L. Bates

WE GUARANTEE that of this issue 5,650 copies were printed; that of these copies 4,195 were mailed to regular paid subscribers, 346 were provided for counter and news company sales, 211 were mailed to advertisers, 27 were mailed to employees and correspondents and 871 were provided for new subscriptions, copies lost in the mail and office use; that the total copies printed this year to date were 33,000—an average of 5,500 copies a month.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

An Appeal to Congress

SENATORS and Representatives, you are about to decide whether or not America is to have a merchant marine.

The situation is this; with the exception of the four freighters recently purchased by Captain Robert Dollar, there is not a privately owned American vessel operating in the trans-Pacific trade between America and Asia. Captain Dollar with all his experience is in doubt as to whether he can successfully operate his new ships but he is going to do his best. If Captain Dollar does succeed in making a go of his American ships under existing conditions, it will be largely because he is a trader as well as a shipowner. He can send his vessels out filled with lumber from his own mills. When one of his vessels lacks a return cargo he purchases copra or some other commodity for his own account and, still further, he runs a feeder service for 1,600 miles up the Yangtze River. Captain Dollar with his large resources might be able to mix a few American vessels with the ships that he operates under foreign flags but without some inducement from the Government, the Pacific Ocean, which is destined to become the center of the world's commerce, will remain bare of privately owned American ships.

Turning to the Atlantic, we find that with the exception of the passenger and cargo ships operated by the United American Lines and the International Mercantile Marine Company there are very few *privately* owned American vessels in the transatlantic trade. Take away the vessels owned by the Shipping Board, the vessels owned by the companies which carry their own products, such as the Standard Oil, United States Steel and United Fruit, and our merchant marine today is no farther ahead than it was in 1914.

This is an appalling situation. The Shipping Board is maintaining today about 70 services covering every trade route known to be of any value but it is doing it at a tremendous cost to the Government. Without the direct and indirect aids proposed by the President, or some equivalent, the Government will be compelled to operate these routes or see them abandoned. The two years that have elapsed since the passage of the Jones Act have demonstrated that, unless some reasonable degree of national aid is assured, private initiative and private capital cannot be interested in these routes which are necessary to protect our overseas trade.

After all, it is the foreign trade in which the country is primarily interested. American ships are but one of the means for promoting this trade but no one can gainsay that the farmers, manufacturers and merchants of this country will receive far more loyal, regular and expeditious service from American ships than they will from the vessels of a country which is our competitor in trade and our possible enemy in war. Every great maritime country in history has spared neither effort nor expense to secure the carriage of the greater part of its sea-borne commerce in its own ships manned by its own men for in no other way can it be certain of the delivery of its goods or of protection in war.

Higher construction costs, higher operating expenses, the probable disposition that will be made of the Shipping Board vessels, together with the experience and established banking, insurance, and merchandising facilities possessed by our competitors have prevented private capital from investing in shipping. These factors will continue to prevent the private ownership of American vessels until capital is assured that Congress will provide reasonable aid until such a time as our shipping is established on a sound and permanent basis.

The enactment of the Shipping Bill which the President has recommended for your consideration will assure the reestablishment of our merchant marine and the retirement of the Government from the ship operating business, which will change the Shipping Board vessels from a liability to an asset. We cannot go on as we are for it is impossible for the managers of Government-owned vessels to feel the same interests or assume the same responsibilities that they would in their own vessels. On the other hand, there is an inherent fear on the part of business men against doing any

American Marine Association Backs Shipping Bill

WHEREAS, the American Marine Association is an organization composed of concerns and individuals identified with the building, repairing and operation of ships and the manufacture of those things with which ships are equipped, and therefore vitally interested in any movement which makes for a real American merchant marine; and

WHEREAS, the President of the United States, both before and since his election, has emphasized the necessity for an ample merchant marine and pledged the country to that end insofar as it lay within his power to so do; and

WHEREAS, following a recent message from the President urging early action, there were introduced in the Congress two bills, designated S 3217 and HR 10644 respectively, both designed to provide legislation which will make it possible for merchant ships flying the American flag to both successfully compete with foreign owned vessels and insure to America the maximum of trade with foreign countries so vital to the welfare of the whole nation; and

WHEREAS, the said bills S 3217 and HR 10644 are based on recommendations of the United States Shipping Board made after exhaustive studies of ways and means of building and perpetuating a merchant marine that will best serve America's interests, be it

RESOLVED, that the American Marine Association hereby endorses bills S 3217 and HR 10644 now before the Congress of the United States and urges their early passage.

FURTHER RESOLVED, that the Secretary be and hereby is instructed to send a copy of this Resolution to each and every member of the Congress, to the press and to such other individuals and organizations as should be informed of our action.

business with an organization that savors of Government ownership.

Gentlemen of Congress, you are about to pass a tariff bill designed to protect the manufacturer and the farmer. Can you consistently refuse to grant to the merchant marine the same form of protection that has developed our other industries?

Marine Insurance Rates

"THE three great elements which constitute the fabric of Foreign Commerce," said Mr. Charles R. Page of the Firemen's Fund Insurance Company in his address before the Ninth National Foreign Trade Convention, "are ocean transportation, marine insurance and banking credits."

In discussing the factors upon which marine insurance rates are based Mr. Page pointed out that "it is perfectly obvious that the operator of the American ship cannot successfully compete for cargo as against the foreign ship, if the shipper must bear increased costs for shipment by American vessels. It is also true that in the past underwriters generally have maintained differentials, not against American ships, as such, but against Shipping Board owned and operated tonnage. For this alleged discrimination it is the underwriter's belief that there has existed ample justification.

"Happily, however, these conditions are passing. The Shipping Board has very wisely called practical shipping men into its service. It has cut the number of its operating agents in half and has retired from active service all but the best of its ships. This is rapidly bringing about the elimination of the differentials against Shipping Board vessels, as such, and has laid the foundation for a cooperative effort between the board and the underwriters to establish parities of rating with competitive lines so far as may, upon impartial investigation, be justified by facts.

"American cargo underwriters stand ready to do their part in the development of American lines and to grant to our ships equal rates for equal conditions of management and tonnage, and equal record of immunity from disaster. They cannot, however, be justly asked to grant equality of rating, if the record shows physical inferiority of tonnage, or inefficiency and inexperience of management, or records of mishaps that overshadow like records of the operations of their competitors. Neither can any other scheme which is calculated artificially to equalize or sweep away disabilities that actually exist, and which ignores sound economic principles established by actual experience, be in the long run other than detrimental to the establishment of our merchant marine on a sound and lasting basis."

In the above statements Mr. Page has given a very important reason for the immediate passage of the Shipping Bill for a differential in marine insurance rates might easily become a greater handicap than the lack of a subsidy. The Government aid proposed in this bill or its equivalent must be obtained, if private operators are to be induced to take over the Shipping Board vessels. The longer the Government is compelled to operate the trade routes that the Jones Law requires where the operating expenses are paid by the board, the more demoralized and inefficient will become the officers, the crews and the managements. The inevitable result of continued Government operation will bring about such a state of inefficiency that the majority of American operators will never be able successfully to operate American privately owned ships on a businesslike basis.

Why Handicap Common Ownership of Cargo and Vessel?

THE exclusion of American vessels from the benefits of the Shipping Bill where there is common ownership of vessel and cargo unless one-third of the capacity of the ships is available for common carriage for ten days preceding sailing dates is wrong in principle and cannot possibly result in a saving to the nation.

It is quite true that the United States Steel Corporation and the Standard Oil Company can easily exist without a subsidy from the Government but neither of those companies nor the Government itself can change fundamental economic laws. The fact that the cost of operation of a vessel varies directly as the cost of living in the country whose flag it flies is not influenced by the wealth or poverty of a vessel owner ought to be evident.

Of course a powerful concern supported by its domestic

Society of Naval Architects and Marine Engineers Indorses the Shipping Bill

RESOLVED, that the Society of Naval Architects and Marine Engineers, at a special meeting held in New York on May 19, 1922, having discussed the bill now pending before the Congress of the United States, known as "A Bill to Amend and Supplement the Merchant Marine Act, 1920, and for other purposes" desires to go on record as heartily favoring the early enactment of this measure into Law.

This Society considers it of vital importance that our country place itself in a position to carry its surplus products to competitive foreign markets in ships owned in America and of American registry, as a matter of prudence and economy in time of peace and as a measure of national defense in time of war.

Be it further resolved that a copy of these resolutions be forwarded to the President of the United States and to the Senate and House Committee having jurisdiction of the pending measure.

business could continue to run its ships under the American flag but it would have to sell its products in foreign markets in competition with goods carried in cheaper ships which could only mean that the difference would have to be made up in the price paid by the domestic consumer. If the "private owner" is to be discriminated against in the forthcoming legislation, it is to be hoped that he will retain his vessels under the American flag without the public being compelled to pay an excessive indirect subsidy.

But there is more probability that these large concerns, and almost a certainty that the smaller concerns, will consider it the better way to transfer their vessels to a foreign flag. If they did, it would mean, in oil tankers alone, a loss to our merchant marine of approximately 40 percent of the privately owned tonnage.

To permit this tonnage to pass out of our hands is to admit that the merchant marine is of no importance as a naval auxiliary; for what could the Navy do, or the greater part of our merchant ships for that matter, without an assured supply of oil fuel? Is it not, with the American people, more a question of an adequate merchant marine than a case of nullifying the efforts of those who have set the example which we all hope America will follow, which is to carry its own products in its own delivery wagons?

A Wise Decision

THE decision of President Harding to let the *Leviathan* remain the *Leviathan* is to be commended. The war name of this famous vessel that carried thousands of American soldiers to and from the battlefields of France should never be changed. Doughboys all over the country will watch its career as the finest passenger ship afloat and the sentiment and pride that they hold for the great ship which was their home through the dangerous submarine zone should be respected.

West of the Appalachian mountain range the *Leviathan* is probably the only American passenger ship that is universally known. Those who travel to Europe from Middle West towns will want to tell their friends when they return that they sailed at least one way on the famous *Leviathan*. Her name, like any well-known trade name, will have a distinct advertising value not only for herself but for the whole American merchant marine.

But the *Leviathan* cannot maintain an express passenger service alone. The White Star Line and the Cunard Line have three giant express steamers each. Why not show the world that America can build a passenger ship that will be second to none and let that vessel take the name of the man under whose administration the American merchant marine will be reestablished—President Harding?

History's Greatest Industrial Achievement

WITH the delivery of the 535-foot passenger and cargo ship *Western World* to the Shipping Board on May 9, not only the greatest shipbuilding program but also the largest industrial achievement in the history of the world was completed. The Shipping Board has been the butt for acrimonious criticism of all sorts; it has been accused of scandalous inefficiency but little has been said of its accomplishments for which the future is bound to give it credit.

Since the *North Bend* was turned over to the Government on May 24, 1917, the board has constructed 2,312 vessels of many different types and of 13,636,711 deadweight tons. These vessels, if placed in a straight line, stem to stern, would extend for a distance of 158 miles and, if steaming a mile and a quarter apart, would reach from New York to Southampton, England. The total deadweight tonnage is equal to the carrying capacity of 388,363 freight cars loaded 35 tons per car.

A still more striking comparison may be made of the power generated by the propelling machinery. Colonel W. P. Wooten, Corps of Engineers, U. S. A., figured that the development of the Great Lakes-St. Lawrence Waterway would deliver 1,464,000 horsepower at the switchboard. The total power that could be developed by the vessels constructed by the board is 4,593,000 indicated horsepower or over three times the amount that we could expect from the St. Lawrence.

To construct this enormous tonnage with adequate shipbuilding facilities would have been a big task but at the beginning of the program there were only 50,000 first class

mechanics available in our shipbuilding industry. It was necessary to expand this number by intensive training to 385,000 men proficient in the trade of building ships. It was necessary to give aid financially and otherwise to 179 yards for plant construction and again it was necessary in carrying out this stupendous project to build 13 marine railways, 17 floating docks and 2 graving docks.

The result of this shipbuilding program has been obscured by the impossibility of efficiently operating vessels under Government ownership but nevertheless our increased share in the carrying trade of the world has been the means of marketing billions of dollars worth of our products when ships were scarce. In 1914 commodities to the value of $368,359,756 were carried in our own ships representing 9.7 percent of our water-borne foreign trade whereas in the fiscal year beginning June 30, 1920, this percentage was increased to 44.8 percent and the value of the imports and exports carried in American bottoms amounted to $5,071,905,981.

Of course no one will challenge the fact that the board and its agencies hold a record for building ships that never has and probably never will be equalled but how many realize what a tremendous industrial undertaking it was? How many realize the daily decisions involving millions and sometimes hundreds of millions that had to be made? How many know that the board had to take the duties and responsibilities of a banker, to become a general contractor providing shipbuilding facilities, to become a manufacturer, increasing the output of ship equipment, to become a lumber merchant, acquiring timber forests, to become an insurance company selling protection? How many know that it built and operated street railways, constructed and operated hotels for housing workmen, homes for the families of workmen, in fact whole towns with paving, water, gas, sewers, theatres and hospitals? Those who know this and the many other things that the board and its agencies accomplished will acknowledge and history will record that the greatest shipbuilding program was also the greatest industrial project.

The Hague Rules

ONE of the important subjects of vital interest to all branches of the maritime industry which was discussed at the Ninth National Foreign Trade Convention was *The Hague Rules*. As everyone knows, every nation has different laws relating to ocean carriers. In our own country the regulations printed on the bills of lading issued by our steamship companies are so long and complicated that it not only takes a long time to read them but they are beyond the understanding of the ordinary man. In addition to this, every steamship company has its own form and some of them several forms which are subject to change overnight. This has caused constant friction between the shipper and the carrier because the shipper has never understood his rights and where losses have occurred the shipper has in practically every case found that he has no right of recovery.

"An International Code is needed," said Mr. Charles S. Haight, in addressing the convention, "because so long as the law remains different in every country, you cannot standardize your forms, nor correct the evils which exist today. Even where changes are admittedly needed, no one nation will act alone, if by so doing its own shipowners will be placed at a disadvantage. As in our Disarmament Conference, all must act together, or no one will act at all."

These rules, which were drafted at The Hague last August by a committee composed of shippers, shipowners, underwriters and bankers, are really a codification of our own Harter Act with three important additions: First, they increase the carrier's liability from $100 to £100 per package; second, they allow the shipper twelve months to present any claim for damage and to bring suit; third, they shift the burden of proof, in cases of pilferage and several other kinds of losses, from the shipper to the carrier, requiring the carrier to prove that the loss did not occur through the fault of himself or his employers.

According to Mr. Haight, these rules if universally adopted will benefit the shipowner, the cargo underwriter and the banker as well as the shipper. The shipowner will be benefited because he will not have to face the complications of different laws in every country, the present irritation will be removed and all carriers will be affected alike. The cargo underwriter will be able to fix his rates with definite reference to known risks and the banker will have a safer bill of lading and, by making the collateral safe, business will inevitably be facilitated.

It is a remarkable thing that the principal opposition to the rules in this country comes from the Chicago packers. The packers want the carriers to be responsible for each package up to its market value and they also want to make them responsible for errors in navigation or in the management of the ship. To do so, would of course cause the freight rate on every package to be determined by its value rather than by its size or weight. This would cause endless confusion and prevent the adoption of a set of rules which would have worldwide uniformity.

However, as Mr. Haight stated, "the rules are actually in force in Europe today. All of the great lines of the North Atlantic Conference are issuing bills of lading governed by the rules to shippers of cargo moving to the United States. The American shipper, however, cannot receive the benefit of the rules until the Harter Act has been changed. Under the law, it is provided that a carrier who issues a bill of lading in violation of the Act shall be subject to a fine of $2,000 for each bill issued. Even though the points of conflict between The Hague Rules and the Harter Act are of comparatively little importance, a carrier cannot be asked to incur the risk of such a penalty by issuing a bill of lading in this country which is in conflict with the Act."

For the information of our readers, a bill has been introduced in Congress which is a short enabling act; it provides that a bill of lading under The Hague Rules shall be lawful, any provision in our statutes to the contrary notwithstanding.

A summer meeting of the Institution of Naval Architects of London, England, will be held in Paris, France, July 4 to 8 inclusive. Papers will be read on the mornings of July 4, 5 and 6, the afternoons being devoted to sightseeing, receptions and visits to industrial works.

Ship Subsidy Is a "Trade Subsidy"

Marketing Our Excess Products of Farm, Mine and Factory Is Basic Object for American Merchant Marine

By "Old Scotch"

PRESIDENT HARDING has but recently been quoted in the daily press as saying that the merchant marine problem is perhaps the greatest confronting his Administration and that, if the proposed legislation—that is, the pending Subsidy Bill—fails of passage, the retrogression of the United States as a great nation may be expected to follow without fail.

In all of his many patriotic utterances, no greater nor more vital truth has ever been expounded. That is the very essence of this entire subject. The hearings thus far have, singularly enough, been far afield from the point at issue. All the testimony and discussion have been confined to the restricted phases of the proposed legislation. Wages of seamen, sale prices of ships, building costs, operating expenses, etc. are all relatively minor subjects compared with the great underlying principle involved in this pending legislation. One of the contemporaneous writers on the subject rightly used a term in a recent article, which seems to fit the subject admirably. It is not a "Ship Subsidy," said he, but in reality a "Trade Subsidy" for the United States.

What a Merchant Marine Is For

The basic object of a merchant marine for America is not the mere possession and operation of ships as common carriers for the whole maritime world, such as England's for example, but for the marketing of our excess products of the farm, mine and factory. We have no aspirations, either expressed or implied, for conducting a merchant marine as a basic industry, as we have already a sufficient diversity of occupations to keep our citizens well employed without going afar on the oceans of the world to seek business of that kind. All we want and need at this time is to round out and develop our existing industrial enterprises by providing, under our own flag and direction, every function which goes toward a complete system. We must treat all the industries of the United States as one great undertaking of which the people of this country are the stockholders. No industrial enterprise of any description can be said to be complete, unless it owns and controls its own delivery systems.

So far as our national enterprises are concerned, we are an isolated community with the great oceans surrounding us. The foreign trade which we have with contiguous territory, served by railroads and other land means of conveyance, is negligible compared with what we should and do have with countries reached only by ocean highways. If we do not have the vehicles for delivery of our goods over these ocean highways, we cannot, in times of keen competition, represented by normal world conditions, expect to transact our business of selling in competitive markets across the seas. The very people we must compete with own their own ships or delivery systems and it is fatuous for us to delude ourselves into thinking for a moment that they will carry our own goods at such rates or in such manner that we will be able to sell our goods in these competitive markets.

If we do not have any foreign trade and can consume all we produce here, there will not be any need for our having ships at all, except a sufficient number to act as auxiliaries for the national defense. But no one claims that we do not have to engage in foreign trade to dispose of our surplusage of goods. It is so elementary a fact that all recognize it. Why then should there be any controversy whatever over the necessity for having our own means for delivering these goods to our customers? The only reason the American people need a merchant marine at all is in connection with the disposal of our national productions, hence why argue over the fact that the Government, for the best interests of all concerned, must by some such means as proposed in this subsidy bill make up the difference in the cost of operation of the ships by our own people?

A Mistaken Conception

Some editorials in supposedly American papers have had the hardihood to re-announce that moth-eaten dictum, that it is not a good economic policy to build up one industry at the cost of others. Such propaganda is the most veritable buncombe. We are not attempting to build up an industry, as such, but merely providing proper and necessary facilities to conduct all our other industries. All avocations share in the benefits of shipping alike. The number of people who would be employed in building and operating a sufficient fleet of vessels to conduct our American ocean-carrying business is entirely negligible when compared with any other of our great basic industries.

The necessary number, comparatively small as they may be, who will engage in shipbuilding and ship operation, must be American citizens and, as such, are entitled to just as good living conditions as all other citizens who use the same degree of skill in their various callings, and no better. To attain that standard of living in a trade primarily of national importance, these people must compete in a wide open field of endeavor with all the people of the world at large. No other American industry has to be thus handicapped, and people engaged in shipping and its allied industries have an inherent right to be placed on an equality of opportunity with all other branches of industry in this country.

Enormous Increase of Our Export Trade

Under the direct operation of steamship lines, or delivery systems, through the medium of the vessels belonging to the United States Shipping Board our export trade has increased enormously over conditions which existed in pre-war times, or would have been obtained if we did not have these ships in operation at this time. True they are now being operated at a loss to the Government of approximately four million dollars per month. Place it at $50,000,000 per year and what is that compared with a foreign trade amounting, even now in a period of great depression, to three or more billions of dollars annually? Does any one imagine for a moment that, if the United States had had no ships of its own at the time the armistice was signed, we would have exported anything like the immense amount of goods abroad we have sold in the last four years? Is there, or can there be, any better demonstration that the money lost in ship operation is a "trade subsidy" rather than a "ship subsidy?"

No shipowner is going to grow rich, if this subsidy bill is enacted, as the terms of the bill will so regulate it that but fair returns may be received by Americans who operate the ships to help our trade. Any industry must be operated at some profit, or who would be found to engage in it for glory alone?

Why Our Tankers Should Be Protected by Subsidies

Some criticisms have been indulged in by opponents of the bill that great concerns, such as the Standard Oil companies

which own and operate their own ships, would be benefited under the terms of the bill. Why shouldn't they be benefited? There are but a very few commodities, which our modern living methods demand, more essential to our peace, comfort and protection than petroleum and its products. A world wide battle is now being waged among the great nations for control of this highly essential fuel. Nationally we are doing nothing to protect the interests of the American people, despite the fact that foreign governments are doing everything possible to gain control of the undeveloped oil-bearing areas which yet remain. It has been predicted by numerous well-informed writers that in another decade we Americans, to satisfy our unsatiable demand for gasoline and other petroleum products, will be buying them from our principal competitor for world eminence. The only organizations which stand between us and such a condition are our great and powerful oil companies. They should, therefore, be protected and encouraged in every legitimate manner by the Government.

What of it, if they should make large sums of money? Any citizen, at all provident, can invest his savings in the shares of these companies and partake of any profits they can make. Unless such organizations can make money, they will not be able to compete with foreign companies aided by foreign governments in obtaining new oil lands. If their ships engaged in carrying oil cannot be operated successfully under the American flag, they quite naturally will be transferred to alien flags and employ aliens at the lower wages to which they are accustomed. We would lose not only the money paid to their crews, which at best is a small matter, but we would lose a great national asset. Wars nowadays are as dependent upon petroleum as they are upon explosives and without an enormous fleet of oil carriers under the American flag we would be in a sad predicament. It must be kept in mind that every oil tanker under our flag is a national asset for defense of the nation. The small amounts proposed to be paid to their owners, as prescribed in the subsidy bill, will barely be sufficient to make up the difference in the cost of operation under the American flag. By all means there should be no restrictions placed upon them by the Government, such as compelling them to offer one-third of their tank space to the public, as proposed in the bill.

Therefore, Mr. Congressman and Mr. Senator, who will soon be called upon to vote on this bill, do not let petty political prejudices interfere with your good judgment. Consider this measure as the great broad national question, which it undoubtedly is, and do not let it ever escape your consideration that its passage will not only make national prosperity possible and probable in times of peace, but that in addition it will add greatly to our safety in time of war when we cannot borrow the equipment of our rivals to fight our battles on the sea, land and air.

Established English Liner Companies Were Able to Make Good Showing in 1921

A STUDY of the reports of the net profits of nine important passenger and freight-carrying English liner companies for the years 1920 and 1921 would indicate that the financial position of the best known companies is nowhere near as bad as the gloomy reports that we have received would make it appear.

In the subjoining table of the profits of these companies and their allocation, it is to be noted that, except where otherwise stated, the profits are shown net after deduction had been made for depreciation, taxation, sinking fund, directors' fees and auditors' remuneration. The net profits for 1921 were 87 percent of those for 1920 and the amounts paid out for dividends were as much as 90 percent of those similarly distributed in 1920. The average rate of dividend, however, ranged from 12.3 to 17.9 percent less. The ratio of profits earned to capital invested, which for these companies is about £15,692,000, was 11.4 percent for 1920 and 10 percent for 1921.

As a further optimistic indication, the report of the Cunard Steamship Company, which is not included in the table, shows that that company made more money in 1921 than it did in 1920.

That shipping investments in Great Britain, when securities are offered by sound financial companies, are received with popular favor is shown by the fact that the Peninsular and Oriental Steam Navigation Company was able to float £3,500,000 of 5½ percent debentures about the middle of March. The issue was over subscribed in less than an hour. The Lamport and Holt Company was also able to float a similar issue for £2,000,000 a week later.

Company	Year Ending		Net Profit	Ordinary Dividend and Bonus	Amount Available	Appropriation			
						Dividends	Reserves	Other Appropriat'ns.	Carried Forward
			£	%	£	£	£	£	£
British India Steam Navigation	Sept. 30	1920	162,710	18.6	184,898	159,436	....	....	25,462
		1921	111,609	11.4	137,072	111,576	....	....	25,496
Cairn Line	Dec. 31	1920	106,816*	14.3	182,938	120,000	....	....	62,938
		1921	70,617*	10.0	133,555	120,000	....	....	13,555
Wm. France, Fenwick	Dec. 31	1920	149,697	21.4	162,294	120,750	28,211	....	13,333
		1921	84,441	10.0	97,774	83,250	....	....	14,524
Houlder Line	Dec. 31	1920	64,831	14.3	67,626	26,125	25,000	....	16,501
		1921	61,130†	10.7	63,881	33,000	....	....	30,881†
Lamport and Holt	Dec. 31	1920	301,871	10.0	402,338	212,841	75,000	14,000	100,497
		1921	314,665	8.0	415,162	213,000	50,000	15,000	137,162
Leeds Shipping	Aug. 31	1920	46,350	14.3	46,350	40,000	....	....	6,350
		1921	53,934	....	60,284	....	50,000	....	10,284
Orient Steam Navigation	June 30	1920	197,434	21.4‡	261,346	92,668	100,000	....	68,678
		1921	196,642§	17.9‡	265,320	144,713	70,440	....	50,167
P. and O. Steam Navigation	Sept. 30	1920	657,377	21.4	772,607	660,668	....	....	111,939
		1921	571,467	17.1	683,405	583,100	....	....	100,305
Rowland and Marwood's Steamship	July 31	1920	109,809	25.0	161,636	55,025	55,040	....	51,571
		1921	99,595	25.0	151,166	55,025	22,000	....	74,141
Total		1920	1,796,895	17.9	2,242,033	1,487,513	283,251	14,000	457,269
		1921	1,564,100	12.3	2,007,619	1,343,664	192,440	15,000	456,515
1921 totals compared with those of 1920		1920	100		100	100	100	100	100
		1921	87.0		89.5	90.3	67.9	107.2	99.8

*After deducting in 1920 £40,000 and in 1921 £100,000 for depreciation. † Subject to Income-tax and other charges. ‡ On Deferred Shares. §Excluding £50,000 transferred from Underwriting Account and £2,479 discount on Debentures redeemed.

Joint Hearings on Shipping Bill Concluded

Chairman Greene Says Lengthy Examination Breaks Record for Consideration Given Any Bill That He Can Remember

THE joint hearings on the Merchant Marine Act of 1922, which closed on May 19, are remarkable from many angles. The amount of information included in the voluminous records of these hearings is enormous. Anyone who will take the trouble to procure and study them will be assured of a liberal education on shipping and shipbuilding matters.

Outside, however, of the expert testimony presented by the leading shipowners, operators, builders and marine authorities, the hearings were distinctly different from those on former bills designed to aid shipping in the interest shown by commercial and industrial organizations. The endorsements of the President's plan that were received from such organizations in the South and the Middle West are ample proof of the fact that the interest in an American merchant marine is no longer confined to the seaboard. Of particular significance was the endorsement of the American Farm Bureau, and the testimony of Mr. J. R. Howard, its president, before the joint committee.

Ships Control Trade

"Ships, in the last analysis, are nothing but the delivery wagons of trade," said Mr. Howard. "The nation which controls these delivery wagons controls a service which produces satisfied customers, increased orders, and an ever-widening circle of prestige. If the other nation controls the ships which carry our products, we shall never be able to reach the markets when the price is best. The other nation will use the ships then; we may when he does not want to.

"The British are today furnishing a service from New York to Brazil. This service is slow, requiring about 14 days, and taken care of by old boats. We can hardly expect better service than this to carry our typewriters, harvesters, plows and a thousand and one other articles to South America unless we do it ourselves. The speed is held down to the service afforded from Great Britain. We shall never build up a fast, satisfactory service on British third or fourth rate vessels. Yet it is upon this fast service which develops rapid mail communication that trade depends and the illustration of the service between United States and South America might be multiplied in other directions. We cannot rely upon others to give the service necessary to build up this trade. If it is to be done, America must do it herself and I am sure we all want it done."

> *"It is an old statement that 'Trade follows the flag.' If we would have an increasing export trade we must create a condition, through legislation, which will give the American shipowner such encouragement and such feeling of confidence and stability in his business, that he can develop all the facilities surrounding the successful operation of our shipping to a point where he can offer to our shippers all the advantages which they might secure through other channels."*—F. R. Todd, vice-president John Deere Company.

Why the Farm Bureau Believes the United States Needs a Merchant Marine

Mr. Howard called attention to the following reasons for an American merchant marine:

"1. The United States is no longer a debtor but rather a creditor nation and must seek the business.

"2. Other nations will be competing in Europe where we market our goods. We must be prepared to put our products into the European market promptly and cheaply.

"3. Transportation, the servant of business, must be available when needed; it will be available only if we control the ships.

"4. The service afforded by foreign-owned vessels is second rate, hampers our exports and makes impossible proper increase of our overseas business. * * *

"Finally, in shipping, as in any other business, the real profit depends upon the volume handled. There is no need for me to tell you that when the available cargo is doubled, the profit may be multiplied not twice but 4 or 5 and even 10 times, or a large deficit converted into a substantial profit. But American ships are infants in the game, and must be aided until they become strong.

"The subsidy, as stated in my telegram to the President, stands on the same footing as the tariff. It is a protection for a weak industry. It is justifiable only when the industry is young. We support a ship subsidy because it is necessary for the growth of the business. When that need is past we are opposed to it.

"The subsidy to be effective must do two things: (1) It must meet the difference in operating costs; (2) it must aid in building up a large volume of traffic. * * *

The Value of Ship Subsidy to the Farmer

"What is the interest of the farmer in this? He sells his grain at the local elevator, his live stock at the nearest primary market, and cotton to the local factor, and his fruit to a jobber or broker. What interest, I say, has he in a merchant marine? The farmer had a vital interest in securing the best possible market price for his products. It has been said so many times that I hardly need to repeat it here that the price of grain is made at Liverpool. It follows that he is interested in the delivery wagon which takes his grain to Great Britain. For a number of years cotton exports have represented practically the entire surplus of American exports over imports. During the season 1921 there were exported from the United States and Canada (and most of the Canadian exports come from America) 2,445,501 barrels and 2,722,327 bushels of apples. Is not the apple farmer decidedly interested in the availability of service which will make it possible for him to dispose of his surplus profitably, and while our exports of live stock are negligible, still our exports of meat and live-stock products are one of the most important in the whole list of American exports. The interest of the farmers is very great in these delivery wagons. The farmer in 1921 exported more than $1,976,000,000 of raw agricultural products; of finished and unfinished agricultural products there were $867,000,000. In addition, the farmer is vitally interested in the welfare of his customers in this country, manufacturers, laborers, merchants, etc.

"I want to stress the advantage it is to the American manufacturer and labor, which indirectly is a very great benefit to the farmer.

"The farmer has a still more direct interest than this. He has organized his own grain-selling agency, his own cotton-

marketing organization, his own fruit-marketing organization. It is not only well within the bounds of possibility but it is very probable that these organizations whose primary object is scientific and orderly marketing will decide to arrange to handle these exports themselves. In such case the American farmer becomes the American shipowner, not because he is primarily interested in shipping but because of the necessity of disposing of his own products.

"We recognize the difficulty of converting this subsidy into units of agricultural products. However, if a 5,000 gross ton ship is loaded full of wheat destined to Europe, it has about 367,000 cubic feet of available cargo space. Wheat in bulk occupies 47 cubic feet per ton of 2,240 pounds. Dividing 367,000 by 47 we have 7,808 tons.

"Multiplying by 2,240 pounds per ton we have 17,489,920 pounds, or, at 60 pounds per bushel, we get 291,498 bushels. The subsidy for 3,000 miles, New York to Liverpool, is $750. Dividing the $750 by the amount of grain, the subsidy amounts to about one-quarter of a cent per bushel.

"Upon the same basis of 367,000 cubic feet of cargo space and 130 cubic feet per ton for cotton we can load 2,823 long tons of cotton in a 5,000-ton ship. This means 6,323,520 pounds, or, at 500 pounds per bale, 12,647 bales. Using $750 once more as the direct subsidy we find this means 5.93 cents per bale. From a southern port the distance would be a little greater, making the subsidy perhaps a cent per bale more. From Galveston it would be for 5,000 miles nearly 10 cents per bale.

"Obviously such a cost is entirely out of proportion to the benefits secured in a constant service available for the disposition of the surplus products. The amount of the subsidy to the boat is a little more than the marine insurance on grain and less than one-fourth of the insurance on cotton.

"I know that marine insurance varies with so many conditions as to make comparison difficult. But the rate quoted from Galveston to Liverpool on cotton in good steel steamers last Saturday was 1 9/16 percent of the value. With cotton selling at 18 cents per pound a bale is worth $90. Insurance then would be $1.408 per bale while subsidy would be 10 cents.

"Grain insurance runs 27½ cents per $100 value during summer months, and 37½ cents during winter months. At present prices at the seaboard this means 37½ cents insurance on 67 bushels or about 5½ mills per bushel in the winter and 4 mills in the summer. The subsidy, however, will be only about 2½ mills per bushel.

"Let us remember that marine insurance is a guaranty against loss from storm. The subsidy will be a guaranty against loss from failure to reach market regularly and when markets are best. Marketing is today the farmer's chief problem. The ship subsidy is our best insurance for orderly marketing of the farmer's exportable surplus."

> *"Several times in the past four or five years we have had shipments for South American ports bound on foreign vessels so split up as to make the first part of the cargo useless on arrival because parts of our machines would be left to come on a second boat and as our goods are threshing machinery we were too late for the season. While we can not, of course, prove that this was done by design and intentions to embarrass the sale of our goods, we feel perfectly sure of the fact and have yet to learn of this happening to our English competitors."*— Findley D. Mount, president Advance Rumeley Company.

Quality of the Opposition

In order that our readers may form their own opinion of the kind of testimony that was furnished by the three or four men who appeared in opposition to the Shipping Bill, we will now quote a few extracts from the *Record*. The first will be from the testimony of Benjamin C. Marsh, representing another organization of farmers.

"Mr. Edmonds. I understood before I came here this morning, Mr. Chairman, that the gentleman had made a remark about the President lending his help to an insidious campaign to rob the people of the United States. I would like for him to enlarge a little on that.

"Mr. Marsh. I didn't quite get your statement.

"Mr. Edmonds. I understand you made the statement this morning before I came here that the President was lending his help to an insidious campaign to rob the people of the United States.

"Mr. Marsh. Yes.

"Mr. Edmonds. Produce the proofs.

"Mr. Marsh. Produce the proofs? Hasn't the President urged the ship subsidy?

"Mr. Edmonds. That is no proof.

"Mr. Marsh. Now, I answered your question, will you answer mine?

"Mr. Edmonds. You answered with no proof.

"Mr. Marsh. Well, I deny that; I say it is.

"Mr. Edmonds. You may deny it. That is your thought. You have no right to make charges that you can not prove.

"Mr. Marsh. I am responsible to the folks that sent me here, not to any agent—not to any Philadelphia Congressman. I make that statement.

"Mr. Edmonds. You don't have to be responsible to me. I don't care who you are responsible to.

"Mr. Chindblom. Let me ask, Mr. Chairman, does the gentleman state that he had the privilege of coming here and making any remark that he pleases to make and not be responsible for it and not subject himself to cross-examination?

"Mr. Marsh. I am willing to be cross-examined.

"Mr. Chindblom. You are not showing that attitude now, sir.

"Mr. Marsh. I welcome it. Didn't the President indorse the subsidy bill?

"Mr. Chindblom. Yes.

"Mr. Marsh. And I denounce the subsidy bill as an insidious steal. If the President indorses the ship subsidy bill, I repeat that the President is indorsing an insidious steal to put over on the American people, and I am going to go all over the country saying that.

"Mr. Chindblom. Oh, well, that won't make much difference, you know.

"Mr. Marsh. Well, now, it may.

"Mr. Chindblom. But for a man to come here, Mr. Chairman, and deliberately offer an insult to the President of the United States and then say that he is not here for the purpose of answering questions put to him by a Philadelphia Congressman, I say is an outrage. * * *

"Mr. Edmonds. Of course, the gentleman airs a lot of views here, and he probably has his own opinion. So far as I am concerned, it doesn't affect me so very much because I know the gentleman's views and have known them for a number of years.

"Mr. Marsh. That is why I am so complimented that you are asking me questions.

"Mr. Edmonds. But you come here and because you happen to have a difference of opinion with the President of the United States, you have chosen to insult him before the committee. That is what I contend that you have done. The President has just as much right to his opinion on subsidies as you have, and if you have got any charges

to make that he is trying to rob the American people you ought to be able to prove them and you have not been able to prove them. I have not heard a particle of proof here in two hours.

"Now, you have made other charges here, you charged that Mr. Howard, the man who leads the real farm union in the United States—you have charged that Mr. Howard was in receipt of $100,000 a year from somebody or other, and that he was subsidized by other people and subsidized by a whole lot of people. Now bring your proof of that.

"MR. MARSH. Sure. * * * *

"MR. MARSH. Now let me correct a further statement. I said the Farm Bureau Federation gets money from the packers. That has been published widely and the fact proven in the farm press, and I say, if they didn't get money from the railway interests for selling the farmers out to the railroad interests in indorsing the Esch-Cummins law, they were miserably poor business men, and they are pretty clever business fellows.

"MR. CHINDBLOM. And of course that proves it, that they got the money, doesn't it?

"MR. MARSH. How is that?

"MR. CHINDBLOM. Your argument that, if they didn't get the money, then something else existed—that proves that they got the money?

"MR. MARSH. No.

"MR. CHINDBLOM. Then why say it?

"MR. MARSH. We are quite justified in making deductions. Do you mean to tell me that they would deliberately in cold blood massacre the farmers the way they did?

"MR. CHINDBLOM. Well, you are just throwing out suspicions and insinuations that everybody from the President of the United States down is corrupt because they disagree with you."

SHIPPING BOARD HONEYCOMBED WITH FOREIGN REPRESENTATIVES

"MR. EDMONDS. I don't want to ask Mr. Lasker. You say the Shipping Board is honeycombed with representatives of foreign governments; now say who they are. Mention their names.

"MR. MARSH. I won't mention any names.

"MR. EDMONDS. I want to get them just as much as you do.

"MR. MARSH. Ask Mr. Lasker and you will find out.

"MR. EDMONDS. I don't care to ask Mr. Lasker; I am asking you. You made the charge.

"MR. MARSH. I will make the charge and let Mr. Lasker disprove it if he can. If you want to know, ask Mr. Lasker; he won't tell me.

"MR. EDMONDS. You mean to tell me that you don't know any representatives of foreign governments in the Shipping Board?

"MR. MARSH. I don't want to go into details. I will be glad to try to get the information from Mr. Lasker. I will write and tell him the question.

"MR. EDMONDS. You deny then that you know who they are. You simply made the charge without any proof at all.

"MR. MARSH. If you want to put that interpretation on it, but if you want to know write Mr. Lasker and find out.

"MR. EDMONDS. If you know any, why don't you say so now. You have got the opportunity.

"MR. MARSH. I have not, but I am going to have a little later.

"MR. EDMONDS. I don't care anything about what you do later.

"MR. MARSH. I do.

"MR. EDMONDS. You simply make the charge here that the Shipping Board is honeycombed with the representatives of foreign governments. You have sent this out to your 600,000 members, yet you decline before a committee of Congress to say who these people are, and I want to know just as much as you do.

"MR. MARSH. I will let you know when I get ready.

"MR. EDMONDS. You are not going to let me know now because you don't know yourself. That is the reason, otherwise you would answer me.

"MR. MARSH. We have had set-tos before, Mr. Edmonds. You sneakingly tried to impugn my record during the war before the House Committee on Merchant Marine and Fisheries.

"MR. EDMONDS. I didn't ever need to impugn your record; everybody knows your record. Do you want it to go in here? I will put it in again if you want to."

STATEMENT OF MR. ANDREW FURUSETH

The statement of Mr. Furuseth, although in opposition to the Shipping Bill, was in reality an able defense of the Seaman's Act. Mr. Furuseth, who is reputed to have framed this Act, is president of the International Seamen's Union of America. He represents the unlicensed personnel which, according to his own testimony, contains only 18 percent of native-born Americans.

Mr. Furuseth's contention is that there is no real differential in operating expenses due to the wages of the crew on an American ship. But, note this quotation from his testimony: "Now, that there is a differential in other directions, I do not deny: and I said in my examination in chief that if, for other reasons, you want a subsidy or you think a subsidy is necessary, that is for you to judge: but please do not make a pack horse out of the crew to carry the responsibility for those injuries."

MARINE ENGINEERS ENDORSE BILL

The statement of William S. Brown, president of the National Marine Engineers' Beneficial Association, may be summed up in the following quotation:

"Wishing to take as little of the committee's time as possible, I will state in conclusion that it would seem that the proposed bill offers the probability, in the opinion of this association, of creating the adequate merchant marine so necessary to the Nation and, at the same time, will provide work for the marine engineers, thousands of whom are either unemployed at the present time or have been forced into other lines of endeavor; it will also provide work for men of the other branches of seafaring who are in a position similar to that of the engineers, and as a whole tend to alleviate the general unemployment situation, particularly affecting those trades involved in the building of ship construction, repairs, manufacture of supplies of various sorts, etc.

"With the passage of the measure this is probable, whereas if the measure does not pass it is absolutely certain that unemployment, especially in all branches of the marine field, will become more acute and the Nation as a whole will be in an even more difficult position than at present with regard to general prosperity and national defense."

NEPTUNE ASSOCIATION ENDORSES BILL

The Neptune Association of Licensed Masters and Mates of Ocean and Coastwise Steam Vessels, Incorporated, is in favor of the Shipping Bill. The Neptune Association is composed of approximately 7,000 licensed masters and deck officers.

"This association," said Mr. John F. Milliken, secretary-treasurer of the organization, "is in favor of the ship subsidy bill. Nearly all of the industries in the United States are protected by a tariff. We believe that it is vitally necessary for our country to have an adequate merchant marine, with legislative protection and Government assistance, to deliver the goods of our country in time of peace; to spread American doctrines and develop American business throughout the world, and to assist our Navy in time of war."

Prospects for American Shipbuilding*

Motorship Economy So Marked That Change to Diesel Machinery Will Rival Change from Sail to Steam

By J. L. Ackerson†

IN order to analyze the prospects for American shipbuilding it is necessary briefly to analyze in turn, first—world shipping, second—world shipbuilding, third—American shipping, and fourth—American shipbuilding.

It is possible to have a revival in world shipping and in world shipbuilding without any great increase either in American shipping or American shipbuilding.

World shipping depends upon international trade, which in turn is dependent upon the desire to exchange international products, the ability to finance this exchange of products, and the time necessary to insure the accomplishment of these two items.

The desire to exchange products, of course, exists. The necessity for this interchange of products also exists, not only on account of trade conditions, but also due to the fact that foreign countries are of necessity under the obligation of exporting goods in order to pay their respective debts.

Although the desire to exchange products exists, the ability to finance this exchange does not, at least for many of the European countries, exist. It is necessary that large credits be established in these countries to start their industries in the manufacture of exports.

Probably the only two countries that are in a position to finance this interchange of products are the United States and Great Britain. At the present moment, the financial interests of Great Britain appear willing to loan money for this purpose. In the United States, at the present moment there does not appear to be that same willingness. Just how long it will be before this will be brought about is uncertain; but probably the time necessary to crystallize public opinion, to effect the necessary loans, and following that to establish manufacturing on a post-war normal basis in the European countries, will be not less than three to five years.

Following this line of reasoning, it would appear to me that the world shipping will not return to what may be termed its normal proportions until this period of time, varying from three to five years, shall have elapsed.

World Shipbuilding

From the time this revival begins, an increased demand for ships will manifest itself. Whether new ships will be built or not as a result of this demand will depend upon two things, first, the tonnage necessary to carry out the increasing international trade; second, the tonnage actually existing at the time.

In viewing this, it should be remembered that on the whole there is no greater tonnage of vessels available today than would have been available today had the World War not taken place. Also, many of the ships now included in the world tonnage are old and obsolete. There have been few replacements of the better types of ships. The war tonnage, as a whole, cannot be regarded as a suitable and adequate increment to the merchant marine.

During the past eight years, comparatively few passenger vessels or combined cargo and passenger vessels, or even high grade cargo liners, have been added to the world tonnage.

The international trade revival that will unquestionably take place in the next three to five years will create a demand for vessels suitable for special trades, and also for passenger and combination passenger and cargo vessels.

These vessels when built will undoubtedly be built in accordance with the advances in engineering that have taken place in the past few years. Notable among these advances is the Diesel engine.

It would appear that when the demand for additional tonnage does manifest itself, the new tonnage required will at least be equal to the annual pre-war construction, possibly even greater.

American Shipbuilding

Although it can be shown with reasonable clearness that there will be a demand for additional world tonnage, it does not necessarily follow that there will be a demand for American tonnage.

American shipbuilding, of course, depends upon American shipping. An increase in American flag shipping depends upon, first, an increase in foreign trade shipping, second, upon the ability of American flag vessels to compete in this trade, and third, upon an increase in coastwise trade shipping. Relatively speaking, there have been, and probably will be, very few ships built in the United States for operation under foreign flags.

Increase in Foreign Trade

Although an increase in international shipping is certain, the question remains whether American operators can operate American flag vessels in competition in these trades with foreign flag vessels.

Several of the larger operating companies are now seriously making this experiment. Most of the ships that are being operated in carrying out this experiment are of special types, for example:

The United American Lines, one of the Harriman organizations, is operating the *Resolute* and the *Reliance* in the first class passenger service between the United States, United Kingdom and the Continent.

That line is also operating second and third class combination passenger and cargo vessels, the *Mount Carroll,* the *Mount Clinton,* and the *Mount Clay,* between the United States and the Continent.

The American-Hawaiian Steamship Company is operating large fast freight liners, the Diesel-engine ships *Californian* and *Missourian* between Pacific ports, Atlantic ports and European ports.

The United States Lines is operating first class passenger vessels between the United States and the United Kingdom.

It is yet too early to predict the results that can be obtained over any sustained period of time in these operations.

The success will probably depend, to a great extent, upon pending legislation. With favorable legislation it is probable that the results will be satisfactory, in which case there will undoubtedly be a decided demand for—

A—Passenger vessels
B—Combination liners
C—Special cargo liners

all for operation in foreign trade under the American flag.

These vessels of necessity will be built in the United States.

*Address delivered before National Foreign Trade Council Convention, Philadelphia, Pa., May 11, 1922.
†Vice-president Merchant Shipbuilding Corporation, Chester, Pa.

The coastwise trade has heretofore furnished the greater part of the merchant work that has been performed in American yards. This trade is increasing. Much of the trade that heretofore has been carried by rail is now being carried by water.

A great part of this carriage is done by special types of ships, as, for example, the Luckenbach ships, American-Hawaiian ships, Red D ships, and Agwi ships.

Many of the ships in these and other lines active in the domestic trade are old and obsolete. Undoubtedly there will be replacements in the respective types in the next few years. Many replacements are actually now in contemplation.

Competition in these trades will bring about a demand for more economical operation. This will be accomplished probably by obtaining new and special types; and by the conversion of existing ships.

Already there is much activity on the part of ship operators looking toward the building of new ships and the conversion of some of the more suitable of the Shipping Board ships.

Diesel Ships

Diesel ships deserve special consideration. Although there is no question regarding the exceptional economy to be obtained in the operation of these ships, American operators have been slow to adopt them.

The economy of operation is so startling that, in my opinion, the change from the present accepted type of machinery to Diesel machinery will make a change in shipping in the next decade which will be not unlike the change from sail to steam.

This change in the ships in future to be built will, in my opinion, extend not only to cargo vessels, but progressively will extend to passenger ships, first with the low powered twin screw passenger ships, and quite probably later to the larger powered ships.

The results, with which all are familiar, of the *William Penn*, which showed a saving of approximately $53,000 in one trip around the world, will inspire a number of operators to demand the same economy.

There will be comparatively few Navy ships built in the next few years. Navy building will be confined to airplane carriers, cruisers, scouts and submarines.

Conclusions

Summing up, it seems to me that the following conclusions are clear:

First—It will take from three to five years to stabilize international finances and to insure the establishment abroad of credits necessary to enable foreign industries to place themselves in a position to export large volumes of goods.

Second—During this period international trade will greatly increase until at the end of, say five years, it will attain what may then be termed its "normal."

Third—That during this period there will be an increased demand for ships. That this demand will cause to be culled from the present stock of unemployed ships those that are most suitable, and will then cause the building of new ships of the most suitable type, representing the advances in shipbuilding during the past several years.

Fourth—That this increase in international trade will bring about the desire on the part of American operators to engage in this trade.

Fifth—That this desire on the part of American operators will, if suitable shipping legislation is enacted, cause them to place contracts in American yards for new and special types of ships for operation under the American flag. That this demand for shipbuilding will be augmented by the demand on the part of American operators for special ships to be used in the coastwise and domestic trade. A part of this demand will be met by the conversion of existing American tonnage where practicable, but a part of it, however, will of necessity be provided by new ships, to be placed in American yards. An increasingly greater proportion of these ships will be equipped with Diesel engines of an approved type.

Sixth—A small demand will exist for naval auxiliaries, as outlined above.

This, then, is how I view the prospects of American shipbuilding—fair, but not alluring.

Operating Problems of the American Shipowner*

Wage and Subsistence Costs—Manning Requirements—Changes Recommended in Our Navigation Laws—The Ship Subsidy Bill

By Eugene E. O'Donnell†

NEVER before in maritime history have operators had to wrestle with the problems of so great a suddenly created merchant marine. In other nations the growth of shipping has been gradual. Here in America our gross register tonnage went up from 8,871,000 in 1917 to 18,282,000 in 1921. All of the amount of this increase was in ships designed for international commerce. Not only has our tonnage thus rapidly multiplied, but American owners and operators have been compelled to face, in most cases with little experience, the exigencies of strange new trade with the ports of distant foreign countries.

Except for the vessels acquired before the war, which in many cases were carefully designed for the work in hand, it cannot be said that the merchant marine as a whole is especially adapted to its particular requirements. The new fleet consists to altogether too great a degree of steamers of comparatively low speed and of the "tramp" order. We are lacking, of course, in swift passenger steamers, but we are lacking also in cargo steamers of the so-called liner type, which after all, if not the backbone of a merchant marine, is a class of ship of very great importance. This undeniably handicaps our owners and operators who contemplate the development of a cargo liner service, for vessels which have no reserve speed will necessarily find it difficult to maintain a regularity of service, especially in the trade like that of the winter months on the North Atlantic.

However, a considerable proportion of one-half of the steel tonnage of the Shipping Board which is characterized as good tonnage contains many ships fit for what may be described as the berth service to distant foreign ports, like the 7,800-deadweight-ton Hog Island ships, the 8,800-ton freighters and the larger shelter-deck and other steamers whose capacity in a few cases runs up to a maximum of 12,000 tons. Here is a fleet not to be despised in any survey of the world's shipping, and until we secure better steamers, these, outside of the "tramp" or bulk cargo service, must be regarded, together with the pre-war ships of the older com-

*Abstract of paper read at spring meeting of Society of Naval Architects and Marine Engineers, New York, May 19, 1922.

†Manager, Marine Department, C. H. Sprague & Son, Boston, Mass.

panies, as the main, active, operating backbone of our merchant marine.

Handicap of Wage and Subsistence Costs

First of the problems of American ship operators in this connection is the hard, undeniable fact that they have to pay more money for the wages and subsistence of their crews than do their European or Japanese competitors. American shipboard wages have historically been from 30 to 40 percent above British shipboard wages, and it is estimated at the present time that British wages are about 15 percent above Scandinavian. This is a handicap which in my judgment, and I believe in the judgment of virtually all practical owners and operators, can be overcome only by national assistance.

A great deal is being carelessly said about the higher "efficiency" and "economy" of American officers and men. It is not to be denied that many years ago, in the heyday of our wooden-built merchant marine, there was a higher efficiency in American ocean ships than elsewhere, generally speaking. But it must not be forgotten that this was an efficiency that had gradually been attained through many years of effort and experience.

It would be idle to pretend that any such relative efficiency has been attained in the brief period of the years between 1915 and 1922. Though we have in our ships many of the best officers in the world, our officers as a whole and on the average fall short of the experience of their European competitors. This is even more signally true of our crews. This is a handicap, however, which time itself will cure; in fact, any disparity on this point between Europeans and ourselves is even now rapidly lessening. I am one of those who believe that, given a fair chance, American officers and crews will gradually reestablish the supremacy which in the last century was theirs as the most capable men of their calling in the world.

American and British Wage Difference

The wage difference between American and British ships is somewhat less now than it has been of recent years, and must be regarded as temporary due to the abnormal condition of world shipping, but it is still a wide difference, as will be demonstrated by the following comparison of the costs of wages and subsistence of an American and a British cargo steamer of 3,500 gross tons, and the wages and subsistence of an American and a British cargo steamer of 6,000 gross tons:

Wage Comparison—American and British Oil-Burning Steamers, 3,500 Gross Tons
April 12, 1922

	A. S. O. A. scale	British scale
Master	$265.00	£42 10 0
First officer	155.00	20 10 0
Second officer	130.00	16 0 0
Third officer	115.00	13 0 0
Able seamen (6)	285.00	51 0 0
Chief engineer	240.00	26 10 0
First assistant	155.00	19 10 0
Second assistant	130.00	16 0 0
Third assistant	115.00	13 0 0
Oilers (3)	165.00	33 0 0
Firemen (3)	150.00	31 0 0
Steward and Cook	105.00	14 0 0
Second cook and baker	70.00	10 0 0
Messboys (3)	90.00	25 10 0
Radio	90.00	13 10 0
Wiper	55.00	....
	$2,315.00	£345 0 0 ($1,507.65)

A. S. O. A. scale	$2,315.00
British scale, present exchange, $4.37 = £1	1,507.65
	$807.35
Subsistence difference	180.00
Total monthly difference	$987.35
Annual difference for 11 months at present rate of exchange	$10,860.85

Comparison of American and British Pay-Rolls—New Scale. 1922
April 12, 1922

Comparison of wages of a steamer of 6,000 gross tons, 3 boilers, coal burning, suitable for general ocean tramping, under the British scale, United States Shipping Board scale, and the American Steamship Owners' Association scale.

	United States S. B.	United States A. S. O. A.	United Kingdom
Master	$270.00	$275.00	45/—
Mate	165.00	165.00	20/10
Second mate	145.00	140.00	16/—
Third mate	130.00	125.00	13/—
Carpenter	65.00	70.00	12/10
Boatswain	......	......	11/10
Able seamen (6)	330.00	285.00	60/—
Ordinary seamen (2)	80.00	70.00	11/—
Chief engineer	240.00	250.00	24/10
Second engineer	165.00	165.00	20/10
Third engineer	145.00	140.00	16/—
Fourth engineer	130.00	125.00	13/—
Deck engineer	70.00	70.00	11/10
Oilers (3)	195.00	165.00	33/—
Firemen (9)	517.50	450.00	94/10
Coal-passers (3)	150.00	120.00	30/—
Steward	105.00	105.00	14/10
Cook	90.00	90.00	13/10
Second cook	70.00	70.00	9/10
Messboys (3)	105.00	90.00	8/10
Radio	90.00	90.00	13/10
	$3,257.50	$3,060.00	492/—
Pounds sterling converted at $4.37			$2,150.04

	British scale of May, 1, 1922 On S. B. scale	British scale of May, 1, 1922 On owners' scale
United States	$3,257.50	$3,060.00
United Kingdom	2,150.04	2,150.04
Difference	$1,107.46	$909.96
Subsistence difference	240.00	240.00
Total monthly differential	$1,347.46	$1,149.96
Annual differential at 11 months	$14,822.06	$12,649.56

In the above comparison a similar number of crew in each vessel has been used, but it is a generally accepted fact that American vessels carry a greater number in the crew than do foreign vessels. This difference is more especially to be found in the "tramp," coastal or short-voyage American steamers as compared with the foreign vessels; while in the case of the passenger liners or cargo liners the British manning scale more nearly approximates our own. On the other hand, the manning scale of Continental European ships will generally be found to be less than the British.

Manning Requirements of American and British Ships

The manning requirements contained in the United States statutes as compared to the requirements contained in the British Merchant Shipping Act are illustrated.

Section 4463, United States Revised Statutes, provides that no vessel of the United States subject to United States laws shall be navigated unless she shall have in her service and on board such complement of licensed officers and crew, including certificated life boat men, as in the judgment of the local inspectors may be necessary for her safe navigation. An entry shall be made in the certificate of inspection covering the number of officers and men required.

A minimum manning scale for the officers is further contained in this section of the law which requires that every ocean or coastwise seagoing merchant vessel of the United States propelled by machinery and every ocean-going passenger vessel shall have a minimum number of licensed officers for the vessel's safe navigation according to the following scale:

"All such vessels shall have a licensed master.

"All vessels of 1,000 gross tons or over navigating on routes of more than 400 miles shall have three licensed mates.

"If the vessel is between 200 and less than 1,000 gross tons, two licensed mates are required.

"If the vessel is between 100 gross tons and less than 200 gross tons, one licensed mate; but if the time required to make the voyage from port to port exceeds 24 hours, two licensed mates shall be required."

There is a specific requirement in this section that the officers shall be divided into three watches, and under this

system the local inspectors require the same number of engineers as licensed deck officers.

The British Merchant Shipping Act is silent as to the number of unlicensed personnel required on board of a British ship, except in the case of emigrant ships, which may be considered as passenger liners in the transatlantic trade or the liners to India, Australia or South Africa. The crewing of these vessels will be dealt with later in this paper. As to the licensed officers, I wish to direct your attention to the fact that the requirements are not positive or mandatory in the full sense and state as follows:

"1. Every British foreign-going ship and every British home trade passenger ship, when going to sea from any place in the United Kingdom, and every foreign steamship carrying passengers between places in the United Kingdom, shall be provided with officers duly certificated under this Act according to the following scale:

"(*a*) In any case with a duly certificated master:

"(*b*) If a ship is of 100 tons burden or upwards, with at least one officer besides the master holding a certificate not lower than that of only mate in the case of a foreign-going ship, or of mate in the case of a home-trade passenger ship.

"(*c*) If the ship is a foreign-going ship, and carries more than one mate, with at least the first and second mate duly certificated.

"(*d*) If the ship is a foreign-going steamship of 100 nominal horsepower or upwards, with at least two engineers, one of whom shall be a first-class and the other a first-class or second-class engineer duly certificated.

"(*e*) If the ship is a foreign-going steamship of less than 100 nominal horsepower or a seagoing home-trade passenger steamship, with at least one engineer who is a first-class or second-class engineer duly certificated."

> *"Uncle Sam is not a Santa Claus. He is giving us no gift, no bonus, in this shipping legislation. All he does is to try to assure for us a fair, even chance in competition. A fair chance is something which we have not had for sixty or for seventy years. If this bill passes, we will have it, and then it will be up to us to make such use of it as was made by the shipowners, operators and builders of the brilliant half century before the Civil War. They were given a chance. They took it, and they made such glorious use of it that the maritime world has not yet forgotten the years when American ships embodied the highest efficiency and success the world had ever seen. What we will have to do now is to prove ourselves as good men as our predecessors in this industry."*—Eugene E. O'Donnell.

While it is acknowledged that most British ocean ships in the foreign trade carry as many licensed deck officers as American ships and frequently as many engineers, the character of the British legislation is such that they may reduce the number at any time and are not subject to the penalties for failure to carry the full quota, as happens in the case of American ships by virtue of the penalty clause contained in Section 4463.

With further reference to the unlicensed personnel on American ships, in addition to the authority reposed in the local inspectors which is contained in Section 4463, Section 2 of the Seaman's Act provides that the sailors while at sea shall be divided into at least two watches and the firemen, oilers and watertenders into at least three watches. The seamen may not be shipped for duty alternately in the fireroom and on deck, and the firemen may not be shipped to perform duty in the fireroom and on deck; while in the American ship on Sundays and holidays the crew shall not be permitted to perform unnecessary duties nor shall they be required to do duty on any week day of more than nine hours while the vessel is in a safe harbor. In this regard, let me again point out that the British law is silent.

Section 13 of the Seamen's Act requires that 65 percent of the deck crew shall be able-bodied seamen and to obtain a full-fledged A. B. seaman's certificate a man must have at least three years' experience on the deck of a vessel at sea.

Section 14 of the Seamen's Act relates to the life-saving equipment and the manning of boats and rafts with a definite number of licensed officers, able seamen and certificated lifeboat men. All boats and rafts carrying more than fifteen persons are required to be in charge of a licensed officer or able seaman. The British Merchant Shipping Act is silent on the question of watches at sea and as to the requirement of the number of able seamen. Only in the case of emigrant or passenger ships does it carry a schedule as to crew requirements.

Again I desire to direct your attention to the moderate terms of the language employed.

"1. Every emigrant ship shall be manned with an efficient crew for her intended voyage, to the satisfaction of the emigration officer from whom a certificate for clearance of such ship is demanded; after the crew have been passed by the emigration officer, the strength of the crew shall not be diminished nor any of the men changed without the consent in writing either of that emigration officer or of the superintendent at the port of clearance.

"2. Where the consent of a superintendent has been obtained, it shall, within twenty-four hours thereafter, be lodged with the said emigration officer."

The Board of Trade regulations, however, contain certain provisions with regard to the manning of lifeboats and rafts. These regulations are not as stringent as the requirements of Section 14 of the Seaman's Act. In the case of a British ship a certificated lifeboat man may take charge of a boat or raft, and this permits stewards and other petty officers to take charge and thereby lessens the requirements as to the number of able seamen.

If American ships were everywhere in the majority in overseas trades, the wage difference might not be so heavy a handicap as it is at present. It is the foreign ships that are far more numerous, and their managers and operators are intrenched in position as ours are not. In order to develop our own merchant marine, we must take a part of their present trade away from our enterprising foreign competitors. I need not point out that it is difficult to do this with ships confined to a relatively few types, maintained at substantially higher costs for wages and subsistence.

National Assistance Absolutely Necessary

There is only one way in which the result which we all seek can be accomplished, and that is by national assistance such as has been recommended to Congress by the American Steamship Owners' Association and the United States Ship Operators' Association in the representations which they have recently made to the Congress of the United States.

It is a matter of regret that our inspection requirements do not make it obligatory that licensed engineers have an adequate shop training. It is more and more manifest that this is needed to reduce repair bills and maintain engine and boiler efficiency.

As to the firemen in coal-burning steamers, we have a present good supply, but relatively few of them are American citizens. The present shipping subsidy bill will certainly contain a stiff requirement of citizenship for the unlicensed members of the crew, at least in the deck and engine departments, and it is a question how such a requirement can be met in coal-burning firerooms. On oil-burning steamers a

large force of citizen firemen, most of them young men, is developing.

One of our greatest present deficiencies is in masters of the requisite business training and experience for the overseas trade. Many excellent captains, good navigators, seamen and executives, have passed most of their careers in the coastwise or near-by trade and are having their first experiences with the purely business problems that present themselves in the distant ports of foreign commerce. It is desirable also that the chief mates of our foreign-going steamers, some of whom will soon succeed to command, should acquire as soon as possible a knowledge of business as it is conducted overseas.

I am of the opinion that a shipping subsidy law should not require an American percentage of more than forty, to begin with, in the deck and engine departments. It might follow in this respect the graduated increase in the proportion of able seamen as provided for in the La Follette seamen's law. To develop what is apparently expected by Congress and the country in the form of an unlicensed seagoing personnel, the greater part American, will require close study and patient effort on the part of owners and operators of steamers in the merchant marine, and could best be obtained through a system of naval reserve training.

> *"So long as any usable part of the government-owned fleet remains in the possession of the Government it will act as a damp blanket on the hopes and plans of American shipowners and operators and also American shipbuilders. There is good reason to believe that, if the now proposed Shipping Bill is enacted, a very large proportion of the good Shipping Board tonnage can be disposed of within two years. American owners and operators very earnestly desire the continuous withdrawal of the Government from vessel ownership and operation until the government-owned fleet is entirely disposed of by sale or scrapping at the earliest practicable date. This is a first essential of the firm development of our merchant marine."*—Eugene E. O'Donnell.

In the La Follette seamen's law are presented not a few difficult problems. This act was passed with the assumption that it would provide freedom—so-called—for seamen. The practical result, however, has been the lessening of discipline on American ships as reported by ships' officers and United States consular agents.

Our steamboat inspection laws and rules and other navigation laws and regulations were made the object of a very careful study more than two years ago by a committee of maritime men established by authority of the Shipping Board—a committee of which Mr. P. A. S. Franklin was the chairman. Mr. Alfred Gilbert Smith was chairman of the sub-committee on construction and inspection, and Mr. J. Parker Kirlin was chairman of the sub-committee on personnel and legal adviser to the committee.

As is known to most of us, that committee completed its deliberations and presented its report to the Shipping Board two years ago, and the legal division of the Shipping Board is now engaged in recodifying and consolidating the navigation laws in accordance with the committee's report. I can do no better by way of indicating what ought to be done to cure the unjust or obsolete features of our maritime laws and rules than by summarizing the recommendations of this committee as this report was recently released to the press by the United States Shipping Board.

Summary of Report of Navigation Laws Committee

It was found that our navigation laws are scattered through a large number of volumes of statutes and regulations passed at different times, and in many cases amendments have been enacted with clauses repealing acts and parts of acts inconsistent therewith, making a comparative study of the various statutes and regulations necessary in order to determine just what the law or regulation is on any particular subject. It was found also that authority to make regulations which were to have the force of law and the responsibility for enforcing the laws were scattered among a number of boards and bureaus in different departments of the Government. The committee considered that next in importance to the recodification of the law was the consolidation of responsibility for enforcement in a single department.

Steamboat Inspection Laws.—The committee found that much of the criticism directed at the Steamboat Inspection Service was due to the mandatory character of the laws under which this service operates and the fact that no discretion is left to the officers responsible for the enforcement of the law.

An example is that of the annual hydrostatic test of marine boilers, using cold water, of one and one-half times the working steam pressure allowed. Practical engineers claim that it is unwise annually to subject marine boilers to a stress the result of which makes doubtful the value of the application of this hydrostatic pressure at such frequent intervals.

A further requirement of the inspection laws is the annual inspection of the hulls of cargo vessels. At these inspections it is required that all cargo be discharged and the boilers emptied in order that the inspection may be made. This means a loss of from twenty-four hours to two or three days, depending upon the size of the vessel.

It is suggested that passenger vessels might very well be subjected to these annual inspections, with the exception of the hydrostatic boiler test, and that the life-saving equipment of all vessels should be annually inspected. The inspection of the hulls of cargo vessels might properly be made at the survey periods, once in three or four years.

It is particularly desirable also that American vessels trading between ports in foreign countries should not be obliged to return to an American port for the periodical inspections required by law and regulations made pursuant thereto. These inspections might well be carried out by representatives of the American Bureau of Shipping located in various foreign ports.

Seamen's Act.—It is the general belief that the repeal of the Seamen's Act will place American shipping on an equality with foreign vessels. This is not the fact, however. What the Seamen's Act really does is to place added burdens upon the American ship which are not applied to foreign vessels, and, while it should be materially modified, there are certain humane features which should remain undisturbed. Those features, which have met with the greatest opposition from shipowners and which have caused the greatest hardships are the language tests, able seamen requirements, the excessive requirement of lifeboat men and the frequent payment of wages to seamen in foreign ports.

Section 14 of the Act, which relates to life-saving equipment, was taken from the regulations of the International Conference on Safety of Life at Sea. These regulations were intended primarily to apply to passenger vessels engaged in trans-oceanic trade. The application of these stringent requirements to our small coastwise and inland vessels has reduced their passenger allowances, ultimately forcing several of these companies to suspend operation.

It has been earnestly recommended by the Shipping Board Committee that Section 13 of the Seamen's Act be so amended that the extreme requirement of three years' apprenticeship for a rating as able seaman be reduced to a reasonable period so that this manifest discrimination against young Americans may be eliminated.

Continuous Discharge Book.—Another important recommendation of the committee affecting the seamen's law and the sea going personnel was one in favor of the introduction into the American service of the Continuous Discharge Book, with its record of the conduct and efficiency of seamen. It has long been in use in the British and other foreign services. This book has already been given out by the Pacific American Steamship Association with marked success and will be utilized also by the American Steamship Owners' Association.

Until the government-owned fleet can be disposed of there can be no objection to the maintenance by the Shipping Board of essential ocean services non-competitive with private enterprise. But this situation must be handled very carefully so that private plans may not be blocked. Every effort ought to be made by the Shipping Board to turn every one of the essential services over to private ownership and management at the earliest possible moment. Many operators dread more than foreign competition even the faintest risk of the competition of their government.

> *"Either this present bill must be promptly enacted, or the United States in defiance of sound business, and in defiance also of the instinct and conviction of the vast majority of its own citizens, will be committed to a policy of government ownership and operation in the shipping business, and worse than that, to a policy of governmental subsidized competition with American private capital and enterprise. Such an unjust policy as this would not be tolerated for a moment by manufacturers. It would not be tolerated by agriculture. It should not be imposed on the merchant marine."*—H. H. Raymond, President American Steamship Owners' Association.

Prompt Passage of Shipping Bill Demanded

Let me emphasize the truth which all practical men of our industry realize, that the government-owned fleet can never be sold until ample national aid is provided for the operation of those ships after they have passed into the hands of those who have the knowledge and the means to use them. Absolutely vital to the success of the American shipowning and operating industry is the prompt passage of the great Shipping Bill proposed by President Harding. If that fails, everything is lost that has been done toward a permanent restoration of American shipping in the overseas trade. If that fails, the American people lose all hope of realizing anything on their $3,000,000,000 investment in the shipping business. The national importance of this measure cannot be overestimated. Our foreign competitors are anxiously watching the result of the present legislative effort in Washington. They know as well as we know that this bill, once enacted, will make America a great commercial power on the seas. They dread the result of national aid applied to shipping exactly as it has been so successfully applied in the past to manufacturing, mining, farming and other protected industries in America.

What the Shipping Bill Will Do

The pending shipping measure offers substantial aid to every branch of our merchant marine. It proposes that 50 percent of the immigration into this country be reserved to American ships. This of itself will be a most powerful help to the regular mail, passenger and cargo lines of transatlantic steamers. Another feature of the bill is the deduction from income taxes of shippers of 5 percent of the freight money on goods exported or imported in American vessels. Though this will not directly benefit the shipowners, it will offer a strong inducement to shippers inward and outward to prefer the American flag and will thus assist to give American ships the full cargoes so necessary to profitable operation. Exemption of net earnings of American ships in the foreign trade from Federal taxation, if the amount of the exemption is pledged to the building or purchase of new ships, will encourage shipbuilding and increase the active merchant marine. The construction loan fund of $125,000,000, while costing the Government nothing in the long run, will promote the building of new tonnage of superior character.

Very important is the provision in the new bill that will make it possible to secure more liberal allowance for depreciation for shipping, thus placing us more nearly on an equality in capital costs with our competitors. President Harding's policy of prompt diversion of the army and navy transport services to the merchant marine is made possible in the new legislation. An extension of the coastwise law to the Philippines is certain to have the same beneficial effect on shipping and trade as the extension of the coastwise law to Porto Rico and Hawaii.

What shipowners and operators are probably thinking most of, because they can measure its advantage in dollars and cents, is the direct aid of the new bill in the form of compensation or encouragement to both cargo ships and mail ships. This is the feature of the new proposal that is most actively discussed. It is the part of the bill that must meet the sharpest opposition. But let nobody imagine that this direct compensation was put into the bill to be pulled out again. Without the direct aid of the proposed compensations or subsidies, the great effort of the nation to solve its shipping problem cannot and will not succeed. The indirect aids are themselves inadequate. If the nation is going to help its shipping it must help it effectively and not place it half-way on an equality with its overseas antagonists. Nothing less than complete action will suffice.

We recognize frankly that, though we need all this entire measure of government help and can do nothing of ourselves without it, nevertheless we cannot lean on government aid alone. Given all these improved conditions, the problem of the American merchant marine must, after all, be actually worked out by American shipowners, operators and builders through their own exertions. We must win our own success, achieve our own destiny. We must be quick to distinguish and adopt the newest and best ideas of ship design and construction. We must operate our ships with the utmost possible enterprise and economy.

Fleet Corporation Salaries to Be Reduced.—The House of Representatives has finally prevailed that the appropriation bill providing funds for the Shipping Board for the fiscal year ending June 30, 1923, shall provide for a reduction of the salaries paid to vice-presidents of the Fleet Corporation. The Senate conferees on May 9 finally agreed to a compromise which allows 6 salaries at not to exceed $25,000 each, and 2 at not to exceed $20,000 each.

Developments In Marine Insurance

What Is "Ordinary Course of Transit"—Barge Canal Coverage—Syndicate and Salvage Operations

By "Bordereaux"

ONE of the eternal questions in the marine insurance market is what is the meaning of "ordinary course of transit" in the warehouse to warehouse clause. The assured finds it difficult to understand how there can be any break in an insurance that covers from the warehouse of the shipper to that of the consignee, even though goods are temporarily placed in warehouse en route. The question has assumed vital interest of late in view of the possible changes in the tariff which have caused some importers to stop their goods at a foreign point awaiting a definite settlement of the tariff controversy. Many importers of Egyptian cotton are, for this reason, ordering their cotton held in Liverpool, and that means storing the shipment and interrupting its transit.

It should be understood by the assured that the moment the transit is broken, not only does the insurance terminate but it does not automatically reattach when the goods are again put in transit; it is treated under marine policies as a new risk. However, if an assured's policy covered both from Egypt and Great Britain, the insurance from Liverpool would attach as a new shipment at the time of the cotton leaving the warehouse for destination.

Numerous phases of this question arise with regard to goods which arrive in the United States and are temporarily stored awaiting distribution. Thus many tea importers who bring teas via the Pacific Coast place them in storage in Coast warehouses for a short time before distributing them throughout the United States. Even though the policies of such importers cover to any point in the United States, the insurance is terminated by the warehousing of the teas and does not reattach on their subsequent reshipment. However, as above indicated, if there were a clause in the policy covering from one point in the United States to another the assured would be covered on reshipment. Many policies contain a specific clause in cases of this kind either covering while in warehouses en route or else providing for the reattachment of the insurance on reshipment.

Still another prolific cause of misunderstanding along this same line arises in connection with goods being placed in bonded warehouses at this port. Many importers are apparently under the impression that, if held but temporarily in bonded warehouses, the policy continues in force, while others with specific insurance for their bonded goods expect the goods to be insured when finally taken from the bonded warehouse to the warehouse of the consignee.

Although the matter of storage and transit warehouses is confusing to the layman, yet the distinction is clear cut, customs and appraisers stores being included in transit sheds while general order, bonded warehouses and other stores used for storage purposes are not considered as transit warehouses. Goods are still in ordinary course of transit while in the former sheds.

Barge Canal Coverage

IT was doubtless gratifying to friends of the New York State Barge Canal to learn that on the official opening date no less than ten fleets awaited the word to sail, and fifteen more got away within a week after. Port Superintendent John S. Gaynor predicts a record season. In boosting the canal, Governor Miller calls attention to New York's unselfish attitude in not charging tolls for the use of this waterway. Up to 1880, when the toll charges were abandoned, $135,000,000 had been collected by New York State through the revenue from this source. Instead of charging for its use, New York has spent $154,000,000, since 1903, in its improvement and enlargement.

Last season many complaints were heard about the failure of the shipping public to take advantage of the facilities offered by the canal for handling both through and local freight. Shippers claim that they dislike being compelled to shift during the winter months to the railroads, with the various changes thus made necessary in their methods of routing shipments, and the slight saving in freight, they insist, is not sufficient inducement to overcome the disadvantages of canal traffic. Many shippers state that the canal insurance charges offset the freight savings; but the underwriters who insure canal barges and cargoes claim that there is no ground for a reduction in rates, as last year did not show a profit, mainly due to numerous strandings in the narrow portions of the waterway.

Registered Mail Losses

THE recent registered mail bond robbery, by which the Chase National Bank is reported to have lost half a million dollars, again directs attention to the hazardous character of insuring bearer bonds. Within the past year far too many marine insurance offices have been hard hit by losses from this source, and several have altogether discontinued writing this kind of business. The rates are so small and the values involved are so large that one loss is likely to wipe out several years' premiums. It is quite possible, indeed, that one heavy loss would make recoupment out of the question. In the robbery above referred to there appears to be some doubt as to whether the transit underwriters' risk had attached, because the policies provide that the risk under the transit policy does not attach until the packages have been mailed. Prior to that time the risk is on the sender or his surety underwriters.

Cotton Flood Risks

MARINE underwriters are considerably disturbed by the recent frequency of damage to cotton by floods in the South. The Trinity River flood at Waxahachie, Texas, washed away more than one hundred bales and damaged eleven hundred more. Of this number it is estimated that fully four hundred bales were covered for flood risk by marine insurance. Under open cotton contracts the flood risk is regularly covered, the charge for such hazard being ten cents, and it is included in the basis rate. Cotton stored in warehouses at the port while under marine policies is subject to additional premium for the flood risk, if such warehouses are less than eleven feet above mean low water.

Lake Self-Dischargers

IT is frequently asked lake cargo insurers what difference in rates is likely to develop in view of the impressive improvements in lake cargo carriers and the facilities for handling shipments. There is, for example, a new type of vessel on the lakes that is known as a self-discharger which

is to be used in carrying ore and other heavy bulk cargoes. This craft will lessen the present time of discharge; and that is saying considerable in view of the fact that a vessel is already able to unload twelve thousand tons of ore and to load an equal amount of coal and sail from port on her return trip the same day she arrives. Oddly enough, the effect of these improvements on underwriting should be to increase the hull rates; the logic being that the less time taken in ports means the more time spent in navigation, with a consequent increase in hazards.

East Coast-West Coast Service

INTERESTING underwriting phases have come to the fore in connection with the first round-trip between New York and the West Coast recently scored by a steamer of the Pacific Mail line. This service can boast of several fine modern vessels especially attractive for passenger carriage and light shipments. The point that interests the underwriters is the numerous stops made, especially on the West Coast of Central America. These interruptions to the voyages are of more interest to passengers and shippers than to insurance men. Such bits of navigation, particularly on the part of large steamers, add considerably to the risk because of the increased hazards of collisions and strandings.

Competition in Repairs

THE well authenticated report is that no less than eight shipyards submitted bids on the steamer *Granite State,* and that the successful bidder got the job at a figure $40,000 lower than its nearest competitor. The hull underwriter views this active competition in repair work with unmixed satisfaction. To him it means a marked saving in both particular average and general average repair costs.

Pacific Coast Rates and Conditions

ON the Pacific Coast rates continue to be uniformly low in the marine insurance market. There has been little stimulus given to a stiffening of the tariff, but there are no results as yet to encourage the underwriters. Conditions are, however, looking up, in that they are slightly more stringent. It is becoming increasingly difficult there for brokers to cover merchandise written with "fancy" conditions. For example, it was recently found impossible to cover in the San Francisco market the risk of leakage of linseed oil in barrels. Eighteen months ago such an offer would not have gotten past the first office to which it was submitted. This indicates a slow but significant return to the normal basis. The theft and pilferage situation has greatly improved of late on the West Coast, although the underwriters are uncomfortably uncertain as to whether this is the result of a betterment of the public moral fiber, or merely because goods simply can not be sold, even by the thieves themselves.

Marine Syndicate Conditions

IN an official summary of its recent annual reports the management of the American Marine Insurance Syndicates makes the statement that from organization, August 10, 1920, to December 15, 1921, Syndicate "B" received total earned premiums in the sum of $679,588.35, and received interest amounting to $8,881.02. Its total payments for losses, commissions and net expenses amounted to $211,402.63. The credit balance, therefore, was $477,066.74 for that period. Syndicate "C" wrote premiums of $8,372,388.96, of which the total of earned premium is $4,207,741.47. To this should be added interest amounting to $32,989.99. The total of payments for losses, commissions, net expenses, premium tax and expense reserve was $2,989,134.11; making the credit balance $1,251,597.35. There has been practically no activity in Syndicate "B" for almost a year, due to the inability of the Shipping Board to sell its vessels.

It is important to note that the Syndicates' management has met the repeated request of the Shipping Board for relief in the schedule rates, which had been determined upon vessels sold by the Board, so as more nearly to represent the cost of insurance in the world's markets. A general reduction in rates was felt to be impossible, in view of the demoralized condition of the marine insurance markets of the world and that business is being done in foreign markets at rates considerably below what has been current for some years, although the weight of evidence is that the hull business for those years was done at a loss. However, a plan has been formulated to help meet the Board's predicament, which briefly is as follows:

1. Where a private owner's interest is written in "C," the same rates will be quoted in "B" for the Government's interest.

2. Where a private owner's interest is placed with underwriters other than "C," Syndicate "B" will quote for the Government's interest the same rates as would have been quoted for the owner's interest, if insured with Syndicate "C."

All obligations to place such insurance with "B" are suspended and the Government and owners are at liberty to place the insurance in the world market, if so decided in each case by the Shipping Board.

Salvage Association Results

IN a summary of the minutes of the annual meeting of the United States Salvage Association, Inc., Acting Manager Lawrence J. Brengle states that the major part of the work of organization has been in the foreign field. Up to March 1, 1922, the Association had appointed agents at 88 ports. "South and Central America and the West Indies are practically completed," said he, "and our representatives in the United Kingdom, France, Spain, Portugal, Norway and Sweden are likewise established at practically all the important ports. Our main efforts at present are directed at finding suitable agents in Germany, the Levant, Africa, Asia and in the East Indies."

Foreign agents have handled nearly 50 damage cases for the Association. Since beginning business on November 1, 1921, a total of 3,049 damage surveys were handled by the Association's branch offices and agencies in the United States, up to February 1, 1922. Included in this total were 786 damage surveys for private account, and 2,263 for the United States Shipping Board. New York produced the greatest amount of work, having made 1,194 surveys; New Orleans, 441; Norfolk, 321; Baltimore, 217; Galveston, 201; Boston, 159; Savannah, 152; Seattle, 61; and San Francisco, 47. There are now 435 Shipping Board vessels in commission, and on these vessels alone the Association's surveyors are making an average of 150 damage surveys and 100 condition surveys per month.

Masters' Insurance Opposed

A VENTURESOME British insurance company plans to issue a form of unemployment insurance for ship masters when disqualified for service because of an accident, but the proposal is meeting with little support in this country. Our underwriters see in the proposition an avenue for an increase in moral hazards as respects ocean hull and cargo insurance. Guaranteed that their actions are protected by insurance against personal financial loss, unscrupulous masters might easily detect in this device a way to comfortable retirement through the means of a fortunate "accident" at sea.

White Star Liner Majestic: (1) Corner of Lounge, Showing Carved Oak Paneling; (2) Fireplace in Smoking Room; (3) View in Main Dining Room; (4) Sun Veranda of Private Suite; (5) Windows of Private Sun Verandas Have Garden Boxes; (6) In the Palm Court; (7) Writing Desk in Private Drawing Room

White Star Liner Majestic, the Largest Vessel in the World

The New White Star Liner Majestic

World's Largest Steamship Enters Transatlantic Express Passenger Service — Details of Hull and Machinery

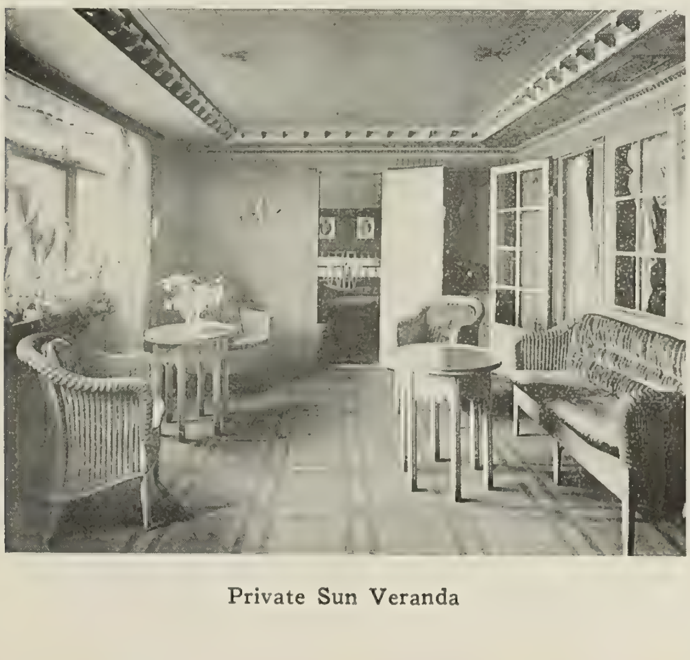
ANOTHER step in the development of the transatlantic liner has been reached by the completion of the *Majestic* of the White Star Line, which arrived in New York on her maiden voyage on May 16. Although falling short of the 1,000-foot liner so often dreamed of and discussed in marine circles in recent years, nevertheless the *Majestic* with her overall length of 956 feet and her gross tonnage of 56,000 surpasses in size any other vessel afloat and with her conversion, before completion, from a coal burning to an oil burning vessel she bids fair to be classed as one of the speediest vessels in the North Atlantic service.

Designed originally for the Hamburg-American Line, the *Majestic* was built in Germany at the yards of Blohm and Voss in Hamburg and, when launched in 1914, was christened the *Bismarck*. With the outbreak of war the construction of the vessel was suspended, but after the armistice was signed she was purchased from the Reparations Committee by her present owners.

The principal dimensions of the *Majestic* are as follows:

Length overall	956 feet
Length between perpendiculars	912 feet
Beam	100 feet
Depth, molded	57.1 feet
Gross tonnage	56,000
Horsepower, designed	66,000
Speed, designed	23½ knots
Number of passengers	4,100

With accomodations for 4,100 passengers, the *Majestic* has nine decks, five of which run the full length of the ship, four being in the superstructure. These four superstructure decks occupy about a third of the ship's length and contain



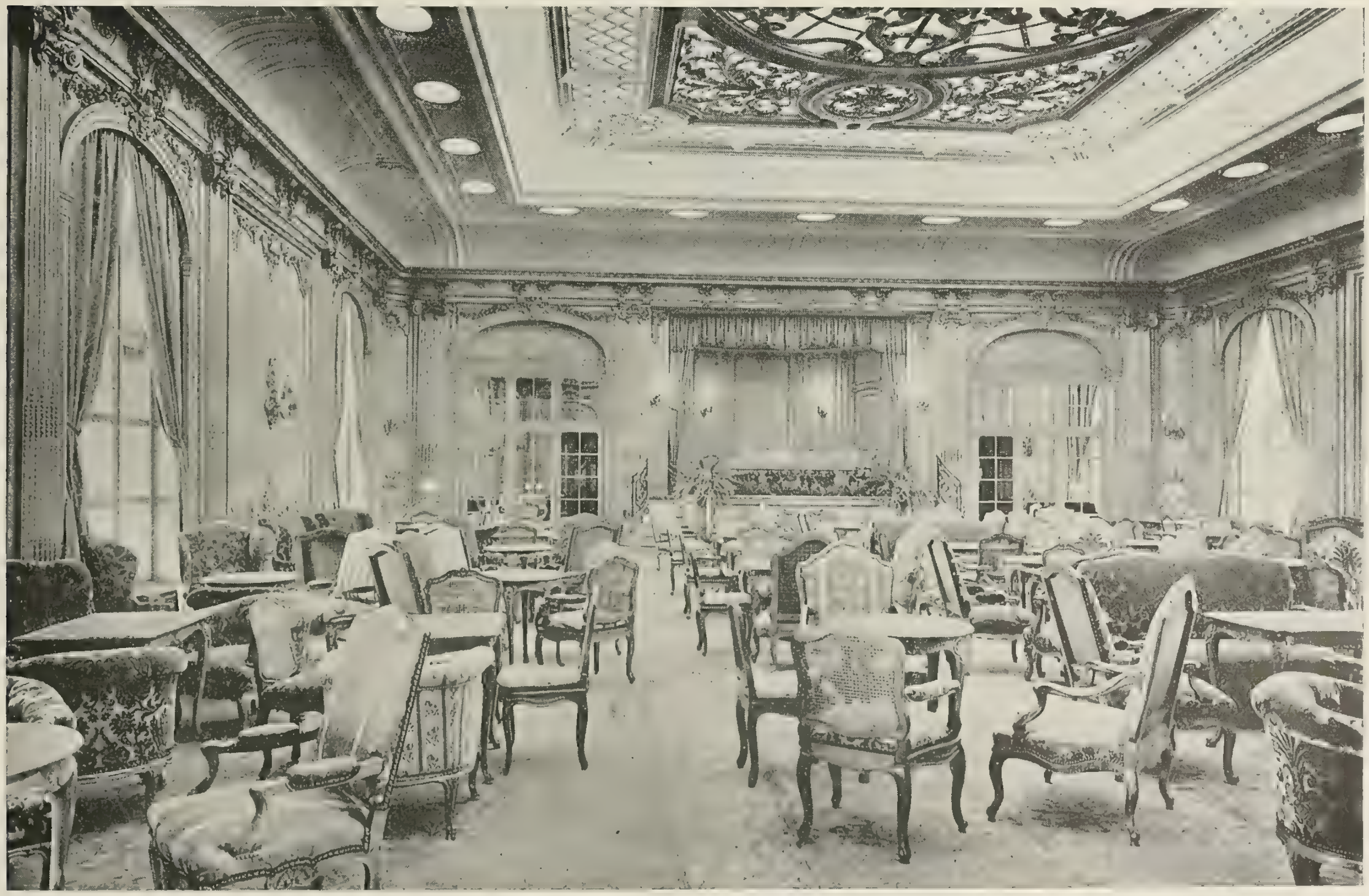
Private Sun Veranda

Swimming Pool

Palm Court, Adjoining the a la carte Restaurant

Main Dining Room

Grand Foyer



The Lounge, the Largest of the Majestic's Public Rooms

cabins and public rooms. Seven of the decks are devoted entirely to the accommodation of passengers. Because of the fact that the stacks are divided below decks and brought up the sides of the vessel it has been possible to provide a broad central foyer through the upper decks, unlike that on any other ship now in commission. Electric elevators and broad starcases of easy pitch connecting all decks are intended to minimize fatigue to the passengers.

Luxurious Public Rooms

On the promenade deck are the main first class public rooms, which, in proportions and elegance, are in keeping with the size and dignity of the ship. The principal rooms occupy a continuous steel deck house two stories high.

From the central foyer on *B* deck entrance is obtained on the one hand to the lounge and on the other to a spacious palm court leading to the a la carte restaurant. Here again advantage is taken of the fact that the boiler casings are divided to provide a clear space of 250 feet extending through these rooms. Forward of the lounge is a reading and writing room and above that the smoking room. The main first cabin dining saloon is on *F* deck with the central part extending to *E* deck, the ceiling being 31 feet high, the loftiest on any ship afloat. The dining room is 98 feet by 117 feet and seats 652 persons. The a la carte restaurant accommodates 200 more.

The lounge is 54 feet by 76 feet; its ceiling is 26 feet high. This room is distinguished by its perfect symmetry, unbroken by bays, projections or roof supports, by the beauty of its oak paneled walls and by the tall French windows. At one end of the lounge there is a concert stage and a large dancing floor which is in use nightly.

Possibly the most striking single feature of the *Majestic's* interior is the Pompeian swimming bath which is decorated with rich marbles and brilliant mosaics. The tiled pool has an area of 820 square feet and a depth of from 4 feet to 9 feet.

Stateroom Accommodations

The *Majestic* has a passenger capacity of 4,100 and for their accommodation 1,245 staterooms are provided of which 472 are in the first class. Many of the first class rooms are in suites that approach in size and equal in luxury the finest apartments ashore. The two largest suites include 8 rooms each with 3 baths.

The *Majestic* is fitted with all the latest accessories and comforts for passengers of all classes. Both steam and electricity are employed for heating the public rooms and staterooms. The ventilation system automatically assures a constant supply of fresh air at the proper temperature to all parts of the ship.

Each class of passengers on the *Majestic* has its own galley, pantry, culinary and service staff. There are no less than eight galleys on the ship.

The second and third cabin accommodations are unusually fine. The second cabin dining saloon, seating 400, has direct communication by electric elevator to the second cabin lounge, reading rooms and foyer. The third class also has a lounge, smoking room and dining saloon and many airy well-lighted two, three and four-berth staterooms.

Propelling Machinery

Through the courtesy of Joseph Wolff, chief engineer of the *Majestic,* we are enabled to present the following notes on the main features of the vessel's propelling machinery:

Propulsion is by four screws driven by Parsons reaction type turbines. There are four sets of ahead turbines and four of reversing turbines. Both ahead and astern turbines are connected to the same shaft in each set. The engines are rated by the builders as capable of developing 66,000 shaft horsepower at 180 revolutions per minute but on the ship's trial trip in the North Sea in April it was found that they developed about 80,000 shaft horsepower at this speed. The astern turbines developed 36,000 shaft horsepower. The steam pressure on the trials was 16 atmospheres or 240 pounds per square inch gage.

The ahead turbines work in series when the vessel is at full speed, the steam passing from the high pressure turbine on the port inboard shaft to the intermediate pressure turbine driving the starboard inboard shaft and thence to the low pressure turbines each driving an outboard shaft. The astern turbines also work in series, the high pressure in each case being on the inboard shaft and the low pressure on an outboard shaft.

The weight of the turbines with their shafts is 3,400 tons. The shafts are 16½ inches diameter. The propellers are four-bladed each with a diameter of 16 feet 6 inches and a pitch of 14 feet 11.5 inches.

Steam is supplied by 48 oil burning Yarrow type watertube boilers, having a total heating surface of 220,000 square feet. The boilers work under forced draft and are fitted with Mumford automatic feed regulators. The fuel oil is burned through the White low pressure system. In all, there are 240 oil burners or five to each boiler. Owing to the character of the system employed, the temperature in the firerooms is no higher than that in the engine rooms. One fireroom attendant has charge of three boilers or fifteen burners. With three watches in 24 hours, only 48 attendants are required to man the fires. There are also employed in the firerooms, however, 36 cleaners, making a total fireroom staff of 84 men as against a staff of 377 which would have been required had the ship burned coal. The latter number would have been represented by 12 chief stokers, 197 firemen and 168 coal passers.

The engine room force on the *Majestic* comprises 70 engineers of all classes, 42 oilers and 4 storekeepers. The engineers include the chief, a staff chief engineer who stands next to the chief in authority, a senior, intermediate and junior with their assistants in each of the three grades, namely: second, third and fourth, besides three electrical, three deck, three sanitary, three hydraulic, one Diesel and others specializing in refrigeration.

The fuel consumption on the *Majestic* has not yet been accurately determined but on the Atlantic passage it will approximate about 800 tons of oil a day at ordinary service speed. Should the vessel be driven to her capacity, the consumption would rise somewhat disproportionately for the added speed secured above her normal rate, which is expected to be about 25 knots. With an oil bunker capacity of 8,200 tons, the *Majestic* will carry nearly enough oil on one filling to make the round voyage between Southampton and New York.

The weight of the complete main engine and boiler plant totals 8,500 tons.

Auxiliary Machinery

The *Majestic's* auxiliary equipment is unusually large and diversified and includes a Diesel engine-driven 90-kilowatt generator installed 19 feet above the bulkhead deck for supplying current not only for 800 emergency lights distributed all over the ship but also for lowering the lifeboats and for the navigating, signalling and emergency wireless equipment.

The main electrical plant consists of five turbo generator sets, each of which develops 288 kilowatts at 115 volts at 2,000 revolutions per minute. Current from the main switchboard is distributed by 32 feed cables, 22 of which are for power purposes, 6 for lighting and 4 for heating. In all, there are 225 electric motors on the ship with a collective capacity of 1,565 horsepower.

Special attention has been given to the heating and ventilating and refrigerating equipment on board. Steam-driven CO_2 refrigerating machinery is installed for the provision storerooms while an electrically-driven refrigerating installation is provided for the refrigerated cargo in the forward part of the vessel.

Combined Passenger and Cargo Liner Conte Rosso

New Italian Liner Conte Rosso

Passenger Vessel Built in England for Lloyd Sabaudo Has Unusually Luxurious Appointments

THE new Italian liner *Conte Rosso* which has recently been completed in the shipbuilding plant of William Beardmore & Company, Ltd., at Dalmuir, Scotland, will shortly take her place in the service of Lloyd Sabaudo Company of Genoa, Italy, which will employ her in its passenger and cargo service between Italy, South America and North America.

The vessel is of the shelter deck type without tonnage openings and was built under special survey to the highest class of Lloyd's Register, the British Corporation and the Register Navale Italiano. The requirements of the International Convention for the Safety of Life at Sea have also been complied with and due consideration given the design of the vessel in order to build it in accordance with the latest regulations of the Italian and American immigration laws.

Designed with a straight stem well raked forward, an elliptical stern with the lower portion bossed out to provide a space for the steering gear, two funnels and two pole masts, the vessel has an exceedingly trim appearance that pleases the eye and conforms to the standards of a well designed ship.

Twin screws are used to drive the vessel in service at a speed of 18½ knots and the main propelling units of geared turbines will develop approximately 17,000 horsepower at this speed.

Decorations

The outstanding feature of this remarkable new vessel is the comfort, convenience and elegance contained in the public rooms and passenger accommodations. The result attained in these quarters represents a marked advance in the appointments provided on passenger ships and will no doubt establish a new precedent in the decoration and arrangement of these spaces on future vessels.

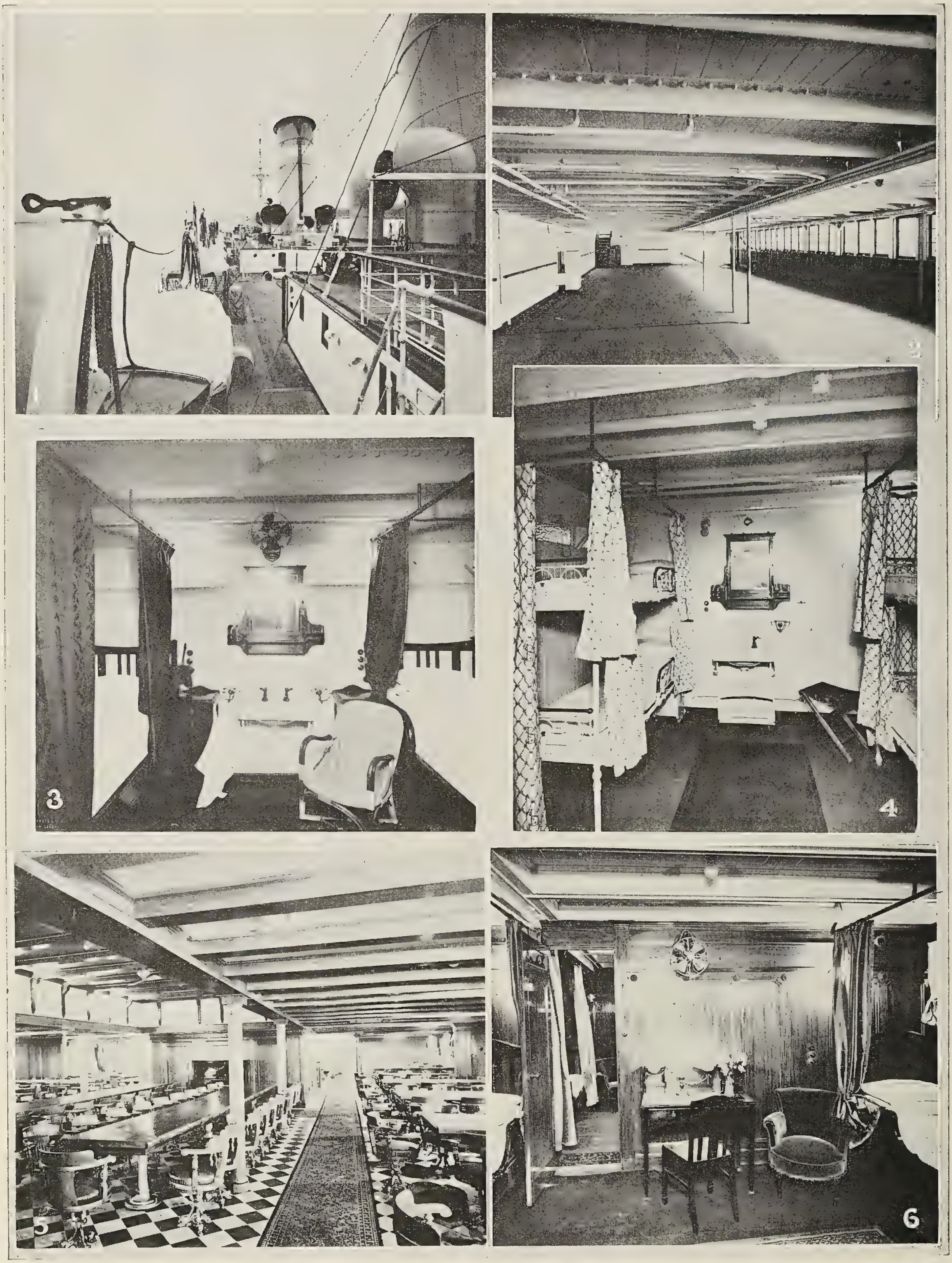
In conformance with the expressed desire of the owners to incorporate in the decorative scheme their experience of the requirements of the Italian and South American service, the whole of the decoration of the first class public rooms was entrusted to the firm of Messrs. Coppede of Florence. These rooms are decorated in a most beautiful and artistic manner that will satisfy the most fastidious. The discriminating traveler will be assured of delightful surroundings during the voyage.

The main entrance hall is in the style of the Italian Renaissance in oak and mahogany. Hand carvings, inlaid work, tapestry and stained glass all play a part in the general scheme.

In the library, the style follows that of the Tuscan Renaissance, the woodwork being polished walnut finely carved and inlaid. A frieze runs around the sides and embodied in the general scheme are some 50 sea and landscape paintings. In lieu of the usual ceiling lamps four wrought iron electric standards with six lights each are located on the deck and each reading and writing table is provided with an individual lamp.

A music room is provided which is arranged and decorated in Pompeian style.

The dining rooms are arranged on two decks, the upper



Italian Liner Conte Rosso: (1) Boat Deck, Aft; (2) Promenade Deck; (3) First Class Stateroom for Two; (4) Second Class Stateroom; (5) Second Class Dining Room; (6) Cabin de Luxe

Italian Liner Conte Rosso (First Class Public Rooms); (7) Smoking Room; (8) Library; (9) Music Room; (10) Entrance to Main Dining Room; (11) Veranda Café; (12) Upper Dining Room

New Italian Liner Conte Rosso

General Information

Service: Passenger—cargo between Italy, South America and North America.

Builder: Wm. Beardmore and Company, Ltd., Dalmuir, Scotland.

Owner: Lloyd Sabaudo Company, Genoa, Italy.

Characteristics

Length, overall .... 591′ 0″
Length, B. P. .... 570′ 0″
Breadth, molded .... 74′ 0″
Depth, molded, to shelter deck .... 40′ 0″
Draft, loaded .... 26′ 0″
Draft, light ....
Block coefficient ....
Midship section coefficient ....
Longitudinal coefficient ....
Speed, loaded, knots 18.5
Cruising radius, nautical miles ....
Framing .... Transverse
Class, highest class Lloyd's Register British Corporation and the Registro Navale Italiano.

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull ....
**Weight Propelling Machinery ....
Deadweight Capacity ....
Displacement ....

(In tons of 100 cubic feet)

Gross register, approx 18,500
Net register ....

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

Anchors ....
Chain ....

Rudder

Area ....
Dia. Stock ....
C. Press. abaft C. L. pintles ....

Complement

Deck officers ....
Deck crew ....
Engineer officers ....
Engineer crew ....
Purser's and steward's department ....
Total officers and crew 442
First-class passengers .... 208 or 160
Second-class passengers .... 268 or 364
Third-class passengers 1,890
Total passengers .... 2,366 or 2,414
Total complement .... 2,808 or 2,856

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	pole	....	....
Derrick posts	..	....	....	....
Booms	..	....	....	....

Discharging Capacity ....

Deck Machinery

(Number, Size, Type)

Steering Gear ....
Windlass ....
Capstans ....
Winches ....

Life Saving Equipment

	No.	Type	Length
Lifeboats	19	..	30′ 0″
Lifeboats	15	..	28′ 0″
Motorboat	1	..	28′ 0″

Propelling Machinery

Boilers

Number .... 6 D. E.—2 S. E.
Type .... Scotch
Length, D. E. 22′ 0″—S. E. 11′ 3″ ....
Diameter .... 16′ 3″
Furnaces, total 32
Fuel, oil—may be converted to coal ....
Draft .... forced
Total heating surface, square feet, 42,154
Total grate surface or furnace volume ....
Superheat, degrees F. 220
Working pressure, lbs. per sq. in. 200
Normal fuel consumption:
Per day, tons ....
Per horsepower hour, pounds ....
Normal steam production:
Per hour per pound of fuel .... lbs.
Total per hour .... lbs.

Engines

Number .... 2 sets
Type, Parson's impulse and reaction, compound steam turbines driving through double reduction gearing ....
Horsepower, total shaft 22,000
R. P. M., high pressure turbine 2,950
R. P. M., low pressure turbine 1,686

Propellers

Number 2
Type .... four bladed
Weight ....
Diameter .... 20′ 0″
Pitch .... 24′ 9″
R. P. M. 92
Projected area ....
Developed area, sq. ft. 130

Auxiliary Machinery

(Number, Size, Type)

Machinery Space

Condensers, main .... two
Condenser, aux. .... one
Evaporators .... two
Distiller .... two
Filters, feed, (2) main (1) aux. ....
Feed water heater .... one
Fuel oil installations .... two
Oil coolers .... two
Pumps ....
(2) Fresh water ....
(2) Bilge ....
(2) Ballast ....
(2) Main Circulating ....
(1) Hydraulic ....
(4) Forced Lubrication ....
(3) Main Feed ....
(2) Dual Air ....
(1) Drinking Water ....
(1) Fire and Washdeck ....
(2) Sanitary ....
(1) Aux. Circulating ....
(1) Aux. Air ....
(1) Aux. Feed ....
(1) Ash Ejector ....
(1) Fuel Oil Transfer ....
(3) Forced Draft Engines ....
(2) Ash Ejectors ....

Refrigerating Machinery

(2) CO_2 machines, CO_2 evaporators, (3) brine pumps

Electric Equipment

Generators (3) 150 K.W. geared turbine units ....
Radio ....
Emergency (1) 35 K. W. set driven by an oil engine ....

Holds

No.	Length	Hatches

Capacities

Cargo Space

Compartment

Refrigerated Space

Compartment	Cu. Ft.

Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons

*......cu. ft. per ton; ......gals. per bbl.

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Total			

providing seating accommodations for 72 persons arranged at tables for two, four and six. This room is decorated in the style of the Italian Renaissance and around the sides is a dado carved with tooled and gilt leather panels. Two large pictures of war episodes in the life of Conte Rosso recall the history of the man after whom the vessel is named. The lower dining saloon has seating accommodations for 176 passengers and the decorative scheme is similar to that in the upper dining saloon. One of the distinctive features of the lower dining saloon is a painting by Professor Cavalieri, one of Italy's foremost artists, representing the triumphal return of Conte Rosso to Nice in 1838.

The smoking room is decorated in the Moorish style of the Alcazar in Seville. Mahogany and chestnut are blended with very fine workmanship.

The veranda cafe is decorated in white maple in a modern style of simplicity which gives prominence to the fine grain of the wood.

Accommodations

Accommodation is provided for 208 first class passengers, 268 second class passengers, 1,890 immigrants and 442 officers and crew. An alternative arrangement of cabins is provided for, however, on the upper deck whereby the number of first class passengers can be reduced to 160 and the number of second class passengers increased to 364.

First class cabins are exceptionally large and include six cabins de luxe on the bridge deck, each of which is fitted with private bath and a constant supply of fresh hot and cold water. The woodwork in these cabins consists of framed and panelled mahogany and the furniture of polished African walnut including two large wooden beds, dressing table, writing table and chair, wardrobe and two easy chairs. Doors are fitted to adjoining cabins so arranged as to accommodate families en suite.

On the bridge deck amidships are provided forty-two single berth cabins. Twelve large special cabins for two persons each are arranged on the promenade deck and eleven similar cabins on the upper promenade deck. A feature of the first class staterooms is the fact that with the exception of those fitted for conversion to either first or second class they are provided with beds in each case, no upper berths being fitted. Another feature is that, wherever practicable, intercommunicating doors have been provided between the cabins and each cabin is supplied with a hot and cold fresh water service.

Second class passengers are carried in four-berth cabins, some of which are located on the upper deck, some on the shelter deck amidships and the remainder in the after portion of the bridge deck.

The second class dining room, which provides for a seating capacity of 254 persons, is located on the promenade deck aft and the smoking room for the second class passengers is on the same deck at the extreme after end.

Sleeping accommodations for immigrants are located on the upper and main decks, both forward and aft, and a dining room with a seating capacity of 450 is located on the shelter deck forward. Promenade space for immigrants is provided forward of the dining space and an open promenade above on the bridge deck.

Another of the new innovations incorporated in the design of this vessel is the location of the first and second class galleys on the boat deck. A special advantage of this arrangement is that the locating of the galleys above the level of the public rooms does away with the smell of cooking in the latter. Service hoists are provided which convey food from the galleys to the dining saloons.

The *Conte Rosso* is the newest type of combined passenger-cargo liner, which has found so much favor in recent years, to be launched. The owners have spared no expense in making this vessel one of the finest of its type afloat and there is no doubt but what their efforts will be well received by the passengers who travel the route over which the vessel plies.

Sternwheel Towboat for Mississippi River Service

Steel Western River Steamer to Be Used for Towing Oil Barges at New Orleans—Boilers to Be Oil Fired

THE Charles Ward Engineering Works, Charleston, W. Va., is constructing for service on the Mississippi River and the bayous in the vicinity of New Orleans a sternwheel towboat from designs prepared by Cox & Stevens, naval architects, New York, to the order of the Pan American Petroleum & Transport Company. The vessel, which will be used to tow oil barges from South Pass to points on the river and Bayou La Touche, has the following dimensions:

Length on deck	136 feet 5 3/16 inches
Length, overall	159 feet 8 13/16 inches
Beam, molded	32 feet 0 inches
Beam, overall	32 feet 8¾ inches
Depth, molded	5 feet 6 inches
Crown of deck	5 inches
Draft, mean, with 50 tons of fuel	48 inches

General Arrangement

The boat is equipped with all modern conveniences for efficient operation and the comfort of the crew, including modern plumbing, hot and cold water, steam heat, electric fans, door and window screens and social hall.

The hull and main deck house are of steel construction. Longitudinal strength is obtained by means of five longitudinal hull and two deck trusses. The deck trusses continue aft and form part of the long cylinder beams supporting the paddle wheel. Six transverse bulkheads divide the hull into seven compartments, one of which is utilized for a fuel oil tank.

The bow of the boat is of the modified scow form.

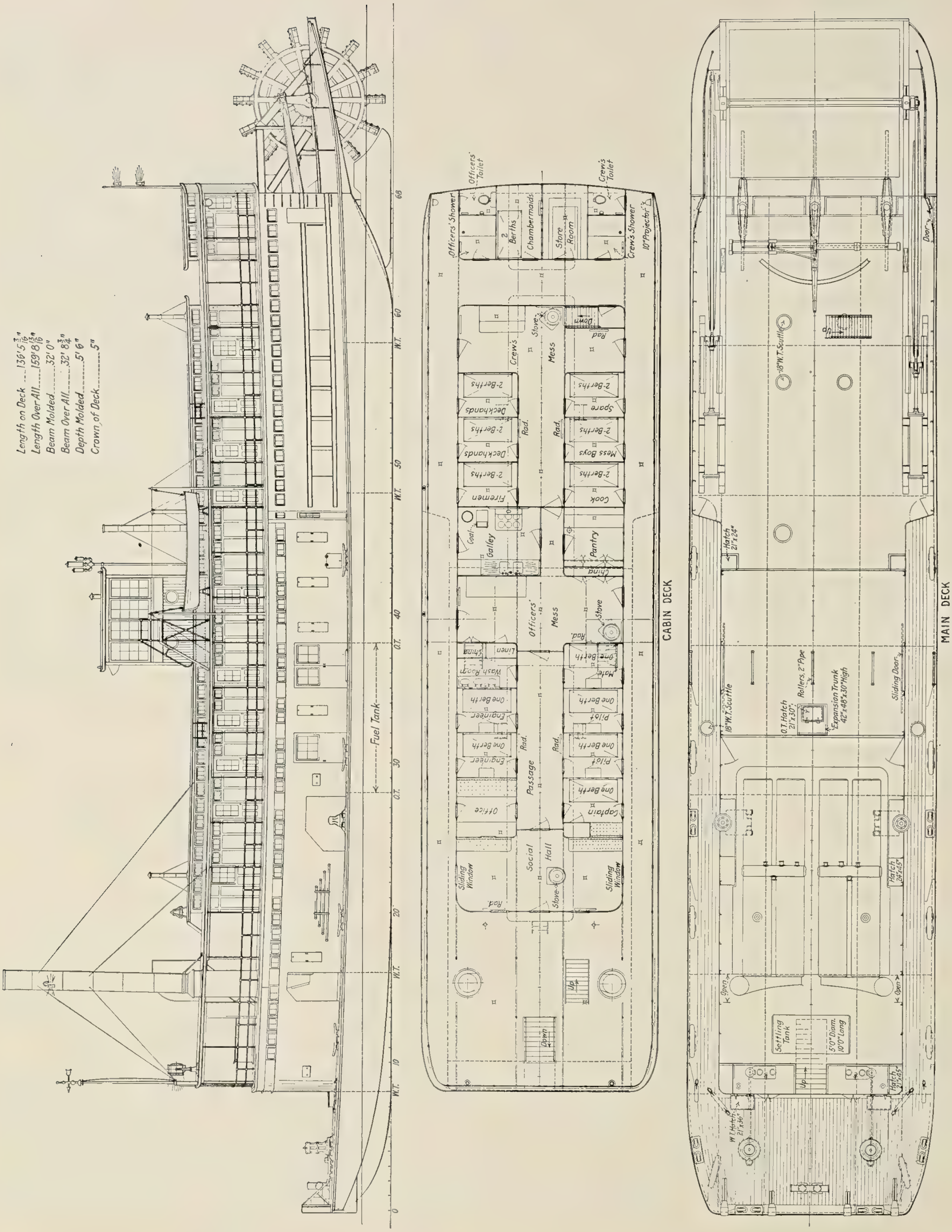
Propelling Machinery

The propelling machinery is of the high pressure non-condensing type with cylinders 18 inches in diameter by 7 feet stroke with balanced poppet valves and "California" cut-off gear as manufactured by the Charles Barnes Company of Cincinnati, O. The paddle wheel is 21 feet in diameter by 22 feet 6 inches long and has 14 buckets 36 inches in width.

Auxiliary Machinery

Two horizontal duplex plunger boiler feeders receive water from an open cold well connected to intakes located above the rounded bilge of the hull.

A duplex pressure coil heater is installed in the exhaust line common to both propelling engines. The surplus exhaust steam is carried to the stacks to increase the draft, or to the



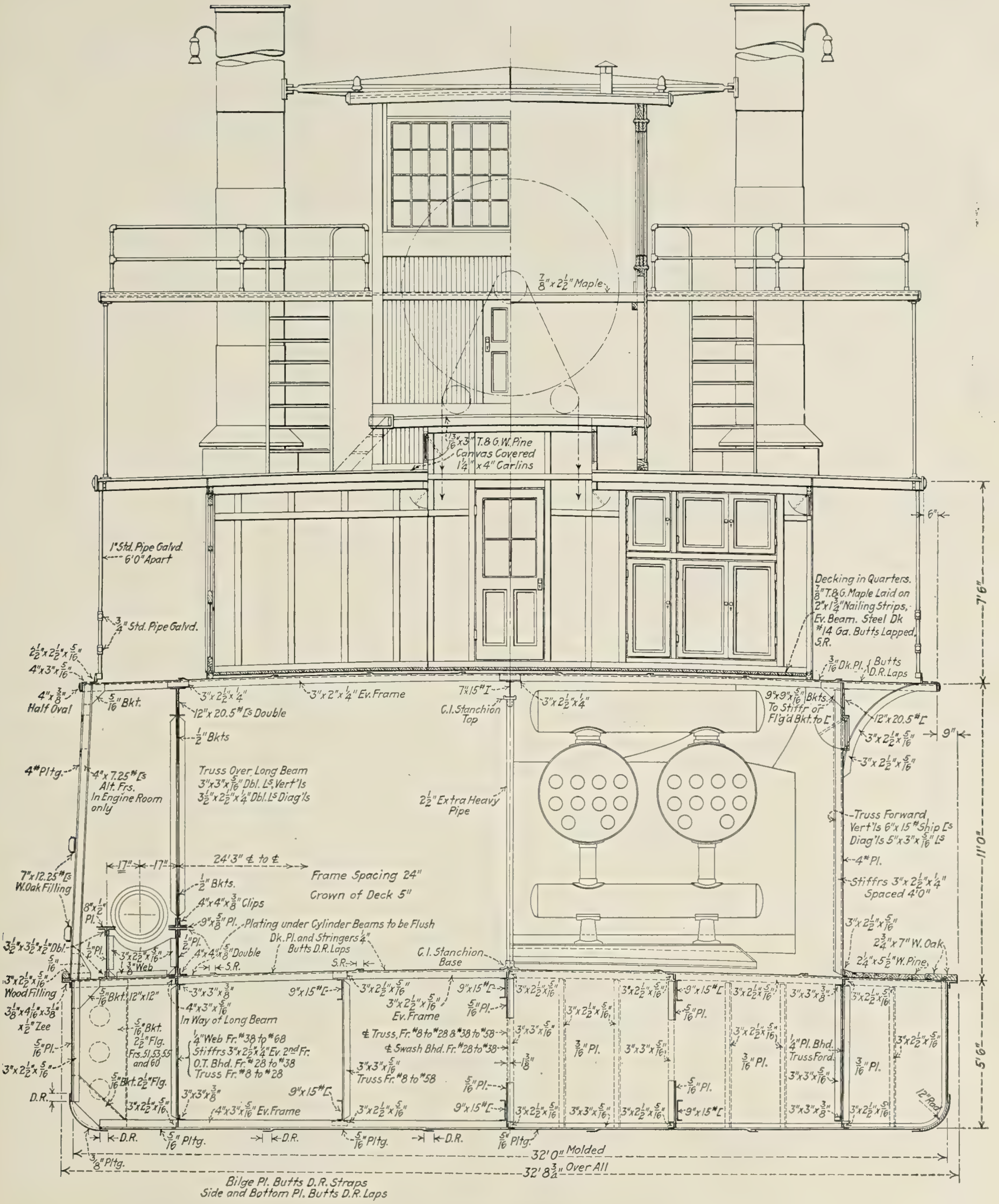
Profile and Deck Plans of New Mississippi River Shallow Draft Sternwheel Towboat

atmosphere, as desired. The boiler feed lines are installed inside the exhaust line to supplement the heating surface of the feed water heater.

A 15-kilowatt generator and sanitary pump complete the equipment. The hull compartments are unwatered by means of syphons.

The boilers are of the horizontal flue type arranged in two batteries with two boilers in each battery. They are 40 inches in diameter by 28 feet long with five 9-inch flues in each, designed for a steam pressure of 220 pounds per square inch. Oil is used for fuel.

Two double drum, double purchase capstans are located



Midship Section

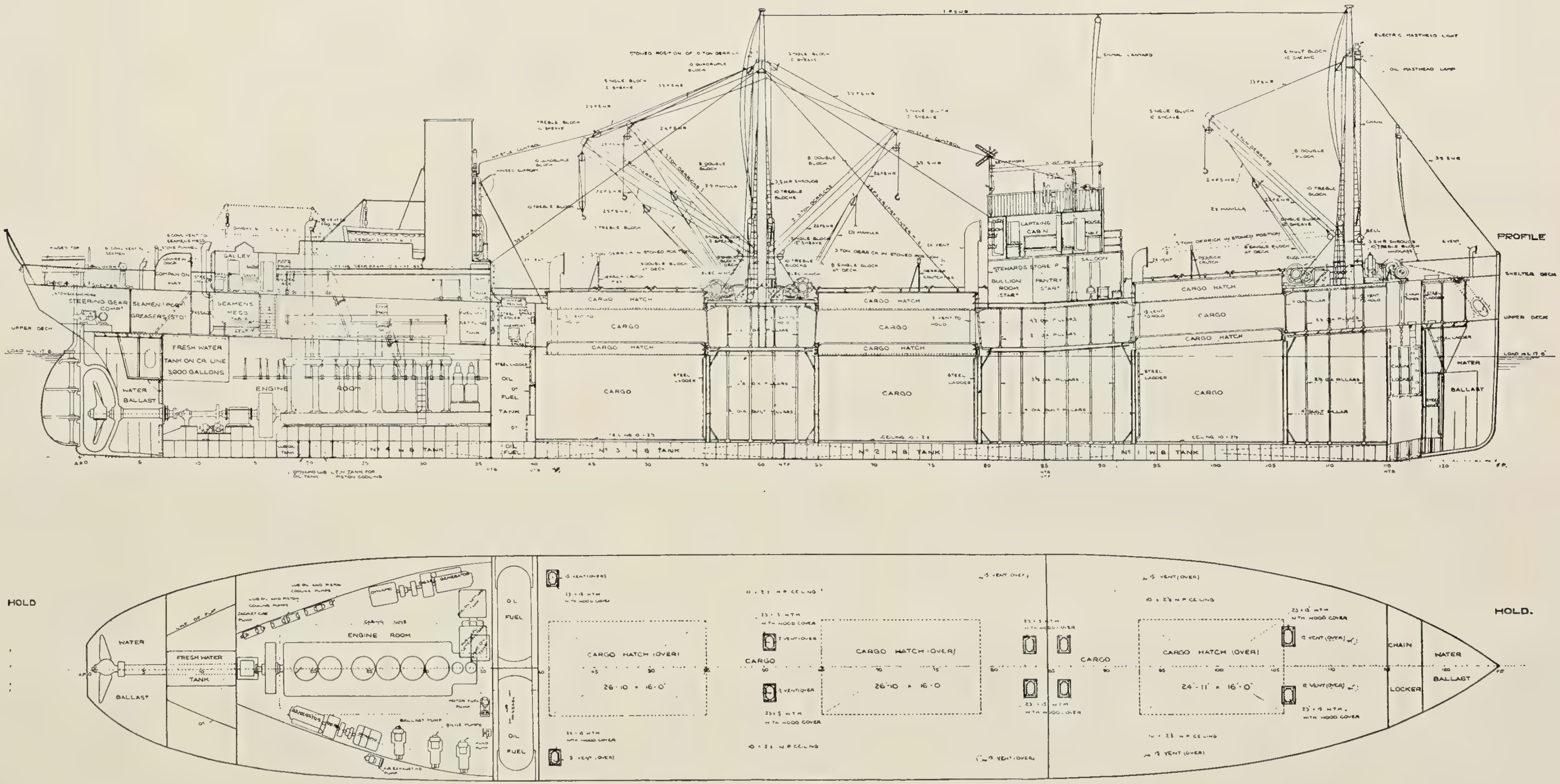
on the forecastle. Abreast the boilers are two side capstans having single drums, single purchase, operated by double reversing engines located below deck.

Three balanced rudders located in ports at the after transom are operated by a ram type steam steering gear installed under the boiler deck. The hand steering arrangement is attached to the inboard or long tiller arm with the tiller lines leading forward under deck and up to the 8-foot pilot wheel on the hurricane deck. Relieving tackle in addition to the above is included.

SERVICE

The boat will tow from one to four steel oil barges having

(*Continued on page* 400)



Figs. 1 and 2.—General Arrangement Plans of Single Screw Motorship Pinzon

Diesel Machinery for Single Screw Motorships*

General Problems Involved in Application of Single Motor to Vessels Over 2,000 Tons Deadweight—Details of Motorship Pinzon

By James Richardson, B.Sc.

NOTWITHSTANDING the vast increase in the number of ships fitted with internal combustion engines, single screw motorships of 2,000 tons deadweight and over have hitherto been exceptional. Increasing confidence in the Diesel engine as a reliable and satisfactory prime mover for marine propulsion, and the desire to take advantage of its economies in classes of vessels of low power, where the single screw arrangement is almost the only one permissible, have recently brought this subject into prominence. In discussing the general problems involved in the application of a single motor in ships of this size, as is the intention of the author in this paper, it may be helpful to give at the outset details of such a vessel.

Figs. 1 and 2 show the general arrangement and Table I gives the leading characteristics of the machinery and equipment of the single screw motorship *Pinzon*, built and engined by Messrs. William Beardmore & Company, Ltd., of Dalmuir. All deck and engine room auxiliaries are electrically driven. No boiler is fitted. The total consumption of fuel oil for all purposes in this ship at 9, 10 and 11 knots at sea, fully laden, in reasonably good weather is 3, 4 and 5.1 tons per day respectively, as given in Table II. The results of the machinery trials are shown by the curve in Fig. 3, and the main engine indicator diagrams are reproduced in Fig. 4.

In connection with the diagrams, attention may be directed to two points. Firstly, the very flat fuel consumption curve which lies below the 0.5 pound per brake horsepower per hour for the main engines, for speeds from a maximum of 125 revolutions per minute to 81 revolutions per minute, i.e., from over 1,400 brake horsepower to 420 brake horsepower. Secondly, an inspection of all the indicator cards shows from the toe of the diagram the very rapid release of the exhaust gases. The pressure drops to atmospheric almost before the bottom dead center is passed. This result is due to the large valve areas possible with the well-known Tosi arrangement of combined inlet and exhaust valves with the director valve controlling the exhaust gases and induction air. A further feature of this system is the extremely low exhaust temperatures, which never exceed 560 degrees F., although measured in the stream of the gases in the cylinder head.

Broadly stated, above 7,000 tons deadweight and 11 knots speed there is a good case for the retention of the standard twin screw arrangement of oil engines because of the lower total cost, the reduced weight of machinery, the shorter length of engine room, which compensates for the cargo space taken up by the extra shaft tunnel, and the reduced risks of breakdown. The personnel, however, is increased.

Problems Inherent to Single Screw Diesel Machinery

Turning in detail to the problems inherent to single screw Diesel machinery, it may be said first that the dictates of reliability and the limited man power available on board demand that certain operations shall be made possible and certain conditions fulfilled.

(1) The crankshaft shall be capable of being removed and replaced with the minimum dismantling of the main engine parts. As an alternative, the after length of the crankshaft, being the more liable to breakdown, shall be so accessible that it can be readily removed and replaced.

(2) That part of the fuel injection air service common to all the main engine cylinders should be in duplicate, including the blast bottle, so that failure of any pipe, joint, valve or chest, etc., shall not necessitate, at most, more than a momentary stoppage.

(3) Arrangements must be made so that all the valves in the cylinder head can be rotated on their seats by hand.

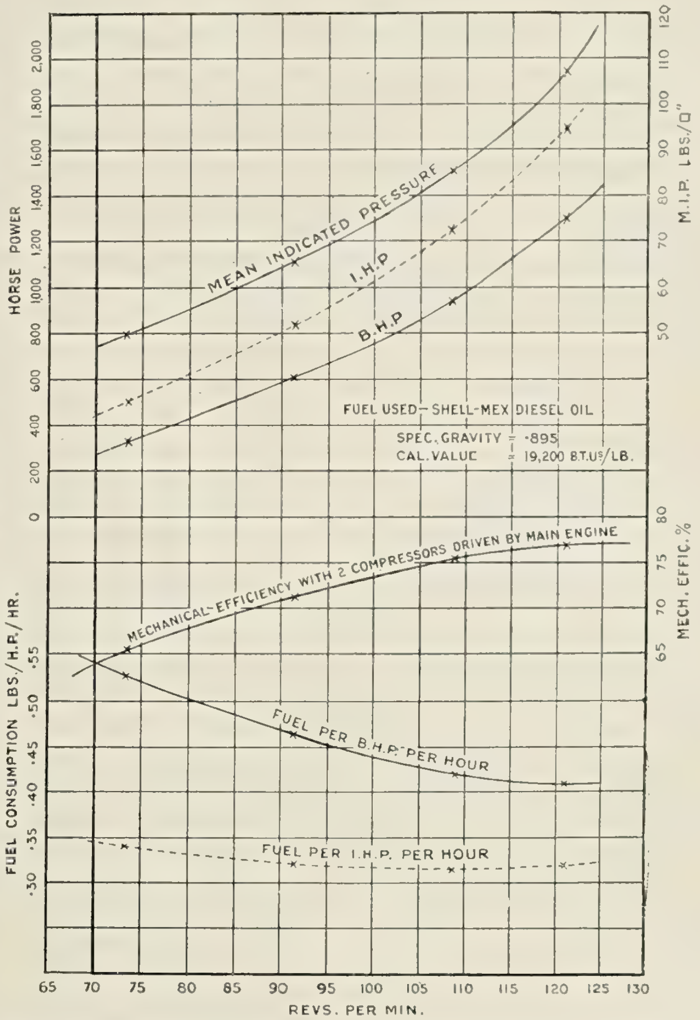


Fig. 3.—Trial Results of Beardmore-Tosi Diesel Engine, M. S. Pinzon

(4) All the main parts, including pistons, must be completely accessible.

(5) The failure of any one or two fuel pumps, supplying fuel under pressure to the main cylinders, must not necessitate a stoppage.

(6) The subject of main engine flexibility, the maneuvering gear, valve setting, and the proportioning of the flywheel, and the whole question of starting or maneuvering air supply must have greater attention than in the case of a twin-engined vessel.

(7) The engine shall be capable of being readily maneuvered by one operator.

As with steam installations, so with motor machinery, the subject of the auxiliaries, both deck and engine room, is only now receiving the attention demanded by its vital importance.

*Paper read at the sixty-third session of the Institution of Naval Architects, London, April, 1922.

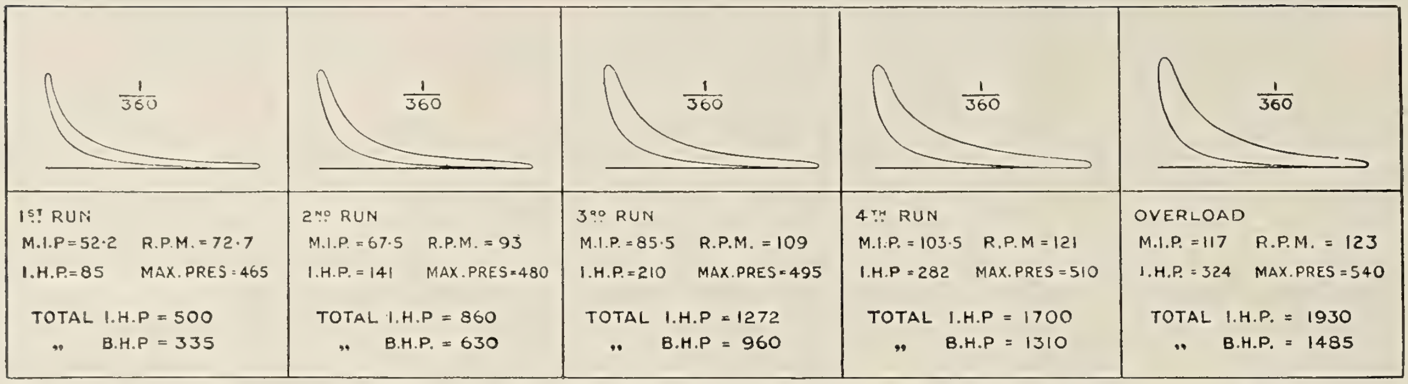


Fig. 4.—Beardmore-Tosi Marine Diesel Engine, M. S. Pinzon. Indicator Cards Taken During Progressive Speed Trials

With motorships, the rival claims of an electric or steam drive still form, and are likely to continue to prove, debatable ground. The alternative of an electric engine room and steam-driven deck machinery is possible, and may commend itself in certain cases. In Table III is given a comparison of the consumption of fuel in similar vessels, one a steamer and the other a motorship, on the same trade. The total consumption of coal is five times that of oil (by weight) in the latter taken over a whole voyage, and is achieved by the utilization of all electric machinery for deck and engine room auxiliaries, deriving current from Diesel-driven auxiliaries. With steam auxiliaries on the motorship, on this trade, the fuel consumption would only be one-third (not one-fifth) that of the steamship.

Steam vs. Motor Driven Auxiliaries

Table III emphasizes clearly the importance in a steamer of the fuel consumption attributable to the auxiliaries generally, and in such conditions as in a coasting trade, in particular, the fuel consumption of the deck machinery. Whereas at sea the ratio of coal to oil for all purposes is 4 to 1, in port this ratio is over 10 to 1, if fires are "banked." A small oil-fired boiler is generally required for the heating of the accommodation and of the oil fuel, although the former can be carried out by electric radiators, and if only a small quantity of oil is carried, exhaust gases can be utilized for heating it.

There is probability of the general adoption in future of a reasonable utilization of waste heat with Diesel marine installations, whereby oil fuel and accommodation heating can be carried out entirely by the main engine exhausts when at sea and partially, at any rate, by the auxiliary exhausts when in port.

The subdivision of the requisite total Diesel electric generator capacity and the desirable margin to be legislated for is an interesting point. Sometimes two generator engines and in a number of twin screw ships four have been fitted. In Table IV the actual electric loads on the M.S. *Pinzon* under various conditions have been tabulated. In general, three sets are preferred, one to be in action normally at sea and in port, and two when maneuvering or working cargo fully, one serving as a stand-by. Three such sets of 50 kilowatts each meet the case shown in the table and only rarely does the minimum load fall substantially below half the power of one unit, a proportion desirable for good working conditions with such machines.

It is seen that the maneuvering load is the highest, even when it may be arranged that the auxiliary compressor is slowed down, if and when the windlass load comes on, and that the radiators may be cut out, if necessary. The maneuvering load comes within the capacity of two generators.

The greatest individual load is the auxiliary compressor required to make up starting air. This machine is of sufficient capacity to supply the main engine with injection air

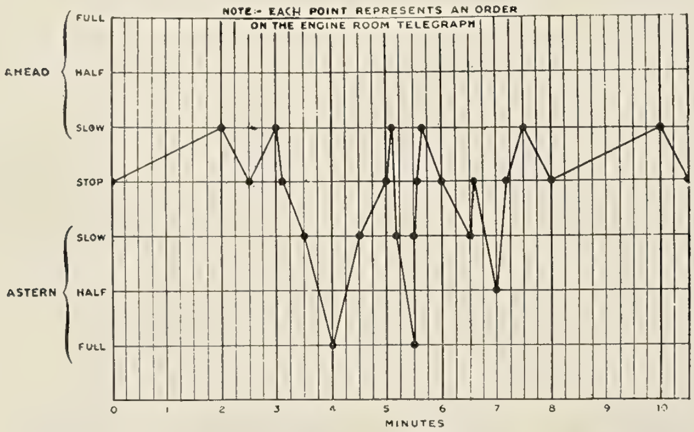


Fig. 5.—Diagram Showing Orders Carried Out on January 13, 1922, Between 6.2 P. M. and 6.125 P. M.

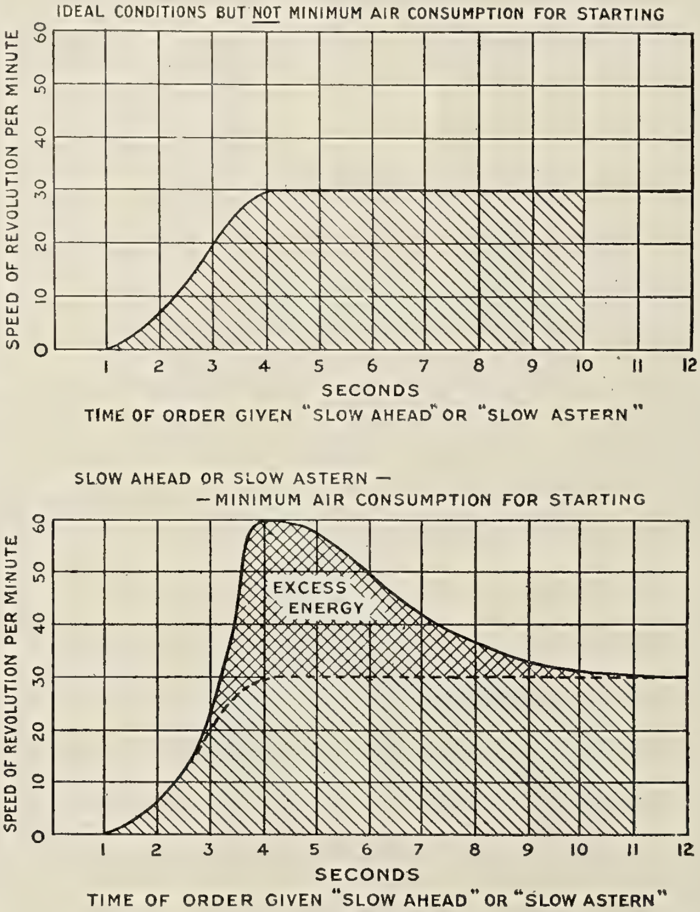


Fig. 6.—Diagrams of Starting, M. S. Pinzon

at full power in emergency, should both the main engine-driven injection compressors be out of action.

Starting Air Storage Capacity

The conservation and replenishment of starting air is a subject of vital importance with internal combustion machinery, as the ability to maneuver the ship is lost if a sufficient quantity and pressure of air are not always available to start the main engine.

Apart from the subject of conservation, reasonably rapid replenishment must be arranged for, as it is possible for a large quantity of air to be lost, as, for instance:

(i) If the exhaust valve of the cylinder into which starting air is being admitted should be hung open;

(ii) If one or more starting air valves in the cylinder head hang open;

(iii) Or, if the engine maneuvering gear should jam in the six or three cylinders on air position and other means not be immediately adopted to shut off the air.

As an example of the demand made upon the starting air storage capacity, two extracts from the log of the M.S. *Pinzon* are given (Tables V and VI) when entering Dalmuir Basin and when navigating up the Bilbao River in Spain. In Fig.

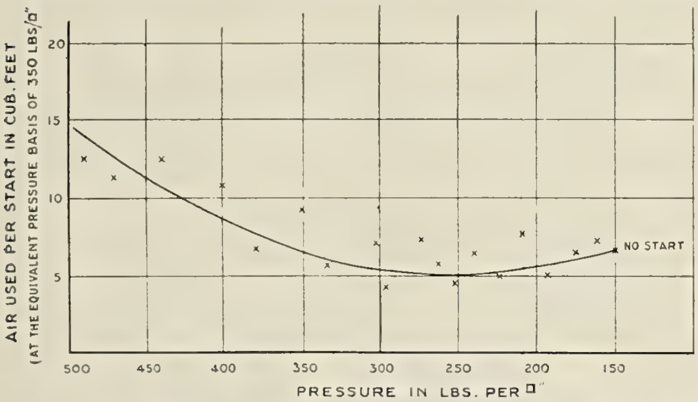


Fig. 7.—Amount of Starting Air Used by Main Engine at Various Pressures of Air Supply

5 is shown diagrammatically 10 minutes of intensive telegraph manipulation involving ten starts of the main engine (extracted from the log given in Table V).

There is one characteristic of these extracts and similar entries in the log to which reference might be made, and that is the prevalence of the repetition of the *motif*, "slow ahead, stop, slow ahead, stop" (see particularly Table VI) having the effect of propelling the ship by repeated thrusts rather than by a sustained effort. It might be suggested that the mimimum sustained power possible with the main Diesel engine is excessive. This is not so. The engine has been run for considerable periods at 24 revolutions per minute corresponding to a maximum speed through the water of 2.5 knots, when full way has been obtained, and a piston speed of 150 feet per minute, giving a ratio of maximum to minimum piston speed, or speed of revolution of 122.5 to 24 or 5.2 to 1. It is difficult to foresee any substantial improvement upon this result, since regular firing of the very minute charges of oil fuel can hardly be expected at a lower piston speed, without some substantial increase in complication, as would be involved, for instance, by preheating the induction air.

This extremely and exceptionally low speed of piston of 150 feet per minute is attained by correct combustion-producing means and by the fitting of a flywheel with suitable momentum effect.

Function of the Flywheel

As is now recognized by Lloyd's Register, the fitting of a fully proportioned flywheel isolates the thrust, intermediate and propeller shafts from the variation of engine-turning moment. The crankshaft is also equally protected from shocks, which might otherwise be transmitted from the propeller. Such a flywheel has no deleterious effects, when starting up or reversing. Momentum is first given by an elastic medium—compressed air—and during a sudden reversal which can be carried out in less than 10 seconds, with full way on the ship, the starting air on being admitted astern, if the engine compression has not already brought the engine to a stop, gently pulls the engine up and gives the initial impulses in the opposite direction.

The diagrams (Fig. 6) show the only remaining justification with modern Diesel engines for the charge of lack of flexibility. When starting up, especially with a view to doing so on the minimum expenditure of compressed air, fuel injection is commenced early and the engine accelerates to "half

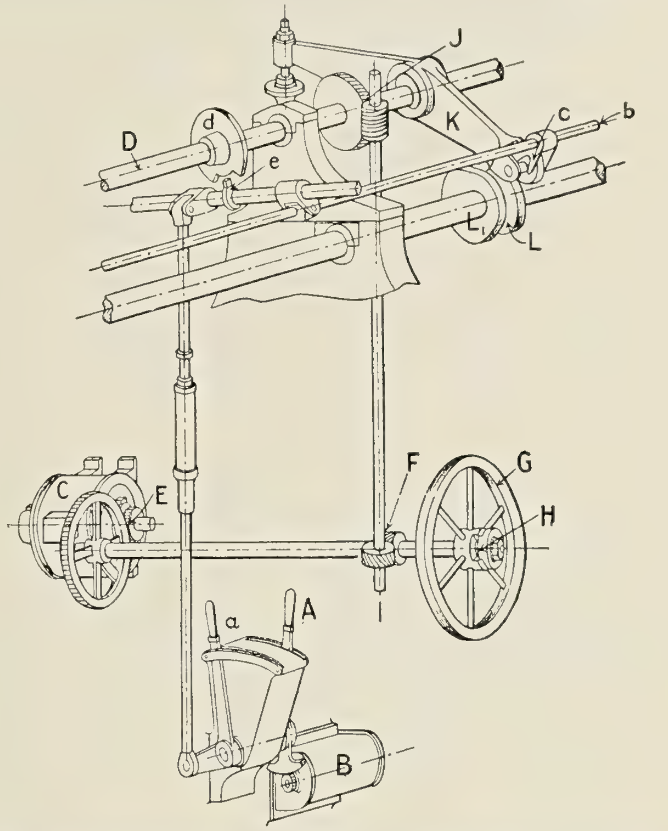


Fig. 8.—Diagrammatic Perspective Arrangement of Beardmore-Tosi Main Engine Starting and Reversing Gear

speed" before retarding to "slow." The total amount of impulse given to the ship is, therefore, approximately twice the ideal. The reconciliation, therefore, of the two somewhat conflicting aims of minimum compressed air used and minimum speed of revolution during starting, without undue complication of the maneuvering gear, is worthy of close study.

It will be found with every type of engine that there is a pressure of compressed air most suitable for starting with the minimum expenditure of air storage energy.

Curves in Fig. 7 show some records and indicate that with pressure between 250 and 350 pounds per square inch the loss of air is a minimum. Whatever the storage pressure—500 pounds per square inch with the *Pinzon*—a reducing valve to ensure that the pressure on the engine side of the air supply is not greater than 350 pounds per square inch, or other means such as working on one of a number of reservoirs, will facilitate the conservation of air.

To consider the replenishment of the storage, Appendix I gives data obtained.

Making the assumption that one start per minute will be the maximum required, over any appreciable length of time, and as the receivers fitted have a capacity of forty starts without recharging—which will cover any exceptional number of starts called for during a short period—it is shown, and has been proved in practice that:

(1) Neglecting the excess injection air from the main engine amounting to 2 cubic feet of free air per revolution of the main engine, there is available air storage and means for replenishment capable of sustaining one maneuver per minute continuously.

(2) If the main engine makes 75 revolutions each move, its excess injection air on being tapped off to the starting bottles will restore what has been taken for the start.

Analyzing a number of logs of "stand-bys," it is found that the average of one maneuver per minute is not exceeded. The average "move," however, is of much less than 75 revolutions, so that actual conditions are a combination of (1) and (2) above, but condition (1) must be satisfied in order:

(*a*) To give a stand-by in case of breakdown, with the main engine injection compressors.

(*b*) To cope with the demands for air for starting during a short spell of maneuvering, calling for more than one move per minute, if air has been lost for any reason.

(*c*) To supply starting air when the main engine injection compressor is either out of action or is working inefficiently and giving no excess air to the starting receivers.

In regard to the actual handling of the engine, see No. (7), page 373, the method of operation and the nature of the gear required will be clear from an inspection of the perspective diagrammatic arrangement given in Fig. 8.

Operating Gear

The starting and reversing of an engine operating on the 4-cycle principle have been brought to the simplest terms, consistent with operation from the usual starting platform. Whatever may be permissible with a twin screw ship, it is considered essential with a single screw installation that the controls should be on the engine room floor level, and the major portion of the gear (as illustrated in Fig. 8) serves to bring the controls to the usual location.

The simplicity of moving the rollers fore and aft, instead of the camshaft, will be appreciated.

Single screw Diesel machinery for the average cargo carrier will be much developed in the near future and the lines of design which will be followed will tend decreasingly to demand a compromise between the best propeller and a smaller and more compact engine, especially with the larger ships.

Speeds of revolution will become standardized as with the steam engine and longer stroke engines will be built. The weight of machinery, the space occupied and the cost will be greater, which will be more than compensated for by the extra accessibility, a built-up crankshaft and a considerably better average propeller performance.

Starting

The hand lever A controlling the starter B of the 5-brake horsepower electric motor C driving the fulcrum shaft D through the media of spur gearing E, spiral gearing F, to which hand wheel G—the speed revolution of this shaft being suitable—is clutched for hand starting at H, and worm gearing J, effects the starting of the engine by causing one-half revolution of the fulcrum shaft D.

The valve-operating levers K are eccentrically mounted on the fulcrum shaft D, the rotation of which causes their roller ends, for starting, to be depressed on to, or for stopping, raised from their respective cams, L for ahead and L_1 for astern.

This lowering or raising of the roller ends of the valve levers K is carried out in such a sequence, as controlled by the angle of the eccentrics, to cause the order of starting to be as follows:

Stop—all rollers clear of cams.

6 cylinders on air—6 air valve rollers on cams.

3 cylinders on air; 3 cylinders on fuel—3 air rollers raised and 3 fuel rollers depressed.

6 cylinders on fuel—3 remaining air rollers raised and 3 remaining fuel rollers depressed.

Reversing

The hand lever *a*, through the medium of links and levers, causes fore and aft movement of the reversing shaft *b*, upon which forks *c* are mounted.

Fore and aft movement of this shaft *b* pulls the rollers along their pins in the wide fork end of the levers K from opposite the ahead cams such as L to opposite the astern cams such as L_1 or vice versa.

A disk *d*, with a gate, is keyed on to the fulcrum shaft D, through which pointer *e* must pass before the rollers can be moved fore and aft for reversal.

The gate in the disk *d* is only opposite the pointer *e* when the valve gear is in the stop position, i.e., all the rollers are clear of the cams.

This is the only interlockment in the gear.

Appendix

M.S. *Pinzon—Data Relating to Compressed Air—Time to Start from Conditionally "No Air in Ship."*

(a) When *Running the Emergency Compressor* of 12 cubic feet per minute swept volume.
Time to fill one blast bottle and one starting bottle for auxiliary generator engine to
800 pounds per square inch = 26 minutes 50 seconds.
1,000 pounds per square inch = 35 minutes 30 seconds.

(b) When *Running the Auxiliary Compressor.*
Time to fill one starting air reservoir to 500 pounds per square inch = 19.5 minutes.
Additional time to top up one blast bottle from 500 to 1,000 pounds per square inch = 2.5 minutes.

(c) *Air Available When Maneuvering Main Engine.*
Air from one main engine-driven compressor (the other being sufficient for blast supply) = 2 cubic feet per revolution.
Excess air from auxiliary engines (estimated at one-third of air made) = 27.5 cubic feet per minute.
From auxiliary compressor = 176 cubic feet.

(d) Assuming no air is taken from main compressors, we have 174 cubic feet free air per minute available. This is equivalent to approximately 7 cubic feet air at 350 pounds per square inch per minute. The main engine uses from 5 to 7 cubic feet of air at 350 pounds per square inch per start or reversal, so that there is sufficient air available to allow of one maneuver per minute continuously, neglecting any surplus air made by main engine.

(e) 70-75 revolutions of main engine supply air for each maneuver (one compressor used wholly for blast), so that, if the main engine is allowed to make 75 revolutions for every maneuver, the starting air can be maintained by the main engine without using any auxiliary supply.

Table I.—M. S. Pinzon

Particulars of Ship and Machinery—Description.

Ship.—Displacement = 3,300 tons. Length = 240 feet. Breadth = 38 feet. Depth = 18 feet.
Winches.—Six fitted, each 16 horsepower.
Windlass.—One fitted, 50 horsepower.
Main Engine—Beardmore Tosi 4-cycle, single-acting, 6 cylinder, 629 millimeters (24¾ inches) bore; 975 millimeters (38⅜ inches) stroke; 1,250 brake horsepower at 120 revolutions per minute.
Main Injection Air Compressors.—Two 3-stage. Swept volume per revolution 1 compressor = 2 cubic feet. Swept volume per revolution, 2 compressors = 4 cubic feet.
Auxiliary Compressor.—Three-stage. Capacity first speed = 88 cubic feet per minute free air. Capacity full speed = 176 cubic feet per minute free air.
Emergency Compressor.—Swept volume = 12 cubic feet per minute free air.
Starting Air Receivers.—Three at 70 cubic feet each = 210 cubic feet. Maximum working pressure, 500 pounds per square inch.
Main Engine Blast Bottle.—One working, one spare fitted. Capacity of one bottle = 5 cubic feet. Maximum working pressure, 1,000 pounds per square inch.
Auxiliary Generators.—Two fitted, each 50 kilowatts, Diesel driven. Engines of trunk piston type, 2-cylinder, 4-cycle, 75 brake horsepower, 250 revolutions per minute.
Compressors (Aux. Gen.).—For 1 generator engine, swept volume of compressor at 250 revolutions per minute = 41.2 cubic feet per minute free air. 2 generator engine, swept volume of compressor at 250 revolutions per minute = 82.4 cubic feet per minute free air.
Starting Bottle (Aux. Gen.).—Two per engine capacity = 3.54 cubic feet each. Maximum pressure, 1,000 pounds per square inch.
Blast Bottle (Aux. Gen.).—One per engine capacity = 1 cubic foot each. Maximum pressure, 1,000 pounds per square inch.
Propeller.—Diameter = 12 feet 6 inches. Pitch = 11 feet.

Table II.—M.S. Pinzon.—Results of Sea Trials

Fuel Consumption per Day (in Tons) for all Purposes.

Speed of ship (fully laden), knots	9	10	11
Revolutions per minute (main engines)	95	105	115
Fuel consumption, all purposes (tons per day)	3	4	5.2

Table III.—M. S. Pinzon and Similar Steamship—*Comparison of Fuel Consumptions at Sea and in Port.*

Steamship—

Triple-expansion engines, single screw.
Ship, 270 feet by 38 feet by 18 feet; draft, 17 feet 5 inches.
Voyage, London to Spanish port.
Indicated horsepower, 1,073.
Revolutions per minute, 75.8.
Speed of vessel, 9.35 knots.
Coal used per day, *for all purposes*, 17.42 tons.
Coal used by auxiliaries per day, 2.5 tons.
Coal used in port per day, discharging and loading, 3 tons.
Banked fires, used per day, 16 days on average voyage, 1 ton.

Motorship Pinzon—

Diesel engines, single screw.
Ship, 240 feet by 38 feet by 18 feet; draft, 17 feet 6 inches.
Voyage, Glasgow to Spanish ports.
Diesel indicated horsepower, 1,290.
Equivalent steam indicated horsepower, 1,170.
Revolutions per minute, 106.
Speed of vessel, 10.2 knots.
Oil used per day, *for all purposes*, 4.5 tons.
Oil used by auxiliaries per day, 0.2 ton.
Oil used in port per day, discharging and loading, 0.37 ton.

Table IV.—M.S. Pinzon. *Load in Auxiliary Diesel Generators under Various Conditions*

	Nominal Motor	Normal Sea Load, Kilowatts		Maneuvering Load, Kilowatts		Load at Starting of Machine,	Port Load, Kilowatts	
	Horsepower	Maximum	Minimum	Maximum	Minimum	Kilowatts	Maximum	Minimum
One jacket-cooling pump	6	5.3	5.3	5.3	5.3	...	...	...
One piston-cooling and lubricating oil pump	6	5.3	5.3	5.3	5.3	...	...	...
One bilge pump	8	6.6	6.6	6.6	...	...	6.6	6.6
Lighting	...	3.5	2	3.5	3.5	...	3.5	2
Steering motor	...	5.2	1	5.2	1	...	...	...
Fuel oil pump	1.5	1.45	...	...	...	...	...	...
Ballast pump	22	18.5	...	...	...	...	...	...
Radiators	...	14	3	14	...	...	14	...
Maneuvering motor	4	...	...	3.75	3.75	...	...	...
Auxiliary air compressor	80	...	...	66	28	80	...	...
Windlass	50	...	...	41.6	...	60	...	...
Fordward winch starboard	16	...	...	...	...	...	...	...
Forward winch, port	16	...	...	...	...	...	14	14
Middle winch, starboard	16	...	...	...	...	...	...	...
Middle winch, port	16	...	...	...	...	...	14	...
Middle winch, starboard aft	16	...	...	...	...	...	...	...
Middle winch, port aft	16	...	...	...	...	...	14	...
Turning gear	7	...	...	...	...	...	6.1	...
Total kilowatts	...	59.85	23.2	151.25	46.85	...	72.2	22.6

Table V.—M.S. Pinzon. *Copy of Log of Engine Telegraph Orders carried out on January* 13, 1922, *entering Delmuir Basin.*

	P.M.		P.M.		P.M.
Half ahead	4.57	Full astern	5.53	Slow astern	6.6.5
Slow ahead	4.59	Slow astern	5.53.1	Stop	6.7
Half ahead	5.4	Stop	5.53.5	Slow ahead	6.7.1
Slow ahead	5.12	Astern slow	5.54	Slow astern	6.7.2
Stop	5.14	Stop	5.54.5	Full astern	6.7.5
Slow ahead	5.15	Astern slow	5.55	Slow astern	6.7.5
Half ahead	5.26	Stop	5.55.5	Stop	6.7.6
Slow ahead	5.26.5	Slow ahead	5.56	Slow ahead	6.7.7
Half ahead	5.37	Stop	5.59	Stop	6.8
Slow ahead	5.40	Slow astern	6.0	Slow astern	6.8.5
Stop	5.46	Stop	6.05	Stop	6.8.6
Slow ahead	5.47	Slow ahead	6.1	Half astern	6.9
Stop	5.48	Stop	6.2	Slow astern	6.9.1
Full astern	5.48.5	Slow ahead	6.4	Stop	6.9.2
Slow astern	5.50	Stop	6.4.5	Slow ahead	6.9.5
Ahead slow	5.51	Slow ahead	6.5	Stop	6.10
Full astern	5.51.5	Stop	6.5.1	Slow ahead	6.12
Slow astern	5.52	Slow astern	6.5.5	Stop	6.12.5
Stop	5.52.5	Full astern	6.6	Finished with engines	6.15

Table VI.—M.S. Pinzon. *Proceeding to Bilbao from Portugalette, February* 1, 1922.

	A.M.		A.M.		A.M.
Stand by	3.5	Slow ahead	4.34	Stop	5.5
Slow ahead	3.20	Stop	4.34½	Slow ahead	5.6
Full ahead	3.28	Slow ahead	4.35	Stop	5.6½
Slow ahead	3.28	Stop	4.35½	Slow ahead	5.8
Stop	3.34	Slow ahead	4.36	Stop	5.8½
Slow ahead	3.35	Stop	4.38	Slow ahead	5.10
Stop	3.35½	Slow ahead	4.39	Stop	5.11
Slow ahead	3.38	Stop	4.40	Slow ahead	5.12
Stop	3.38	Slow ahead	4.41	Stop	5.13
Slow ahead	3.40	Stop	4.42	Slow ahead	5.15
Stop	4.12	Slow ahead	4.43	Stop	5.15½
Slow ahead	4.14	Stop	4.44	Slow ahead	5.16
Stop	4.17	Slow ahead	4.45	Stop	5.16½
Slow ahead	4.18	Stop	4.46	Slow ahead	5.17
Stop	4.18½	Slow ahead	4.47	Stop	5.18
Slow ahead	4.19	Stop	4.47½	Slow ahead	5.18
Stop	4.24	Slow ahead	4.47½	Stop	5.19
Slow ahead	4.25	Stop	4.49	Half ahead	5.19½
Stop	4.26	Slow ahead	4.51	Stop	5.20
Slow ahead	4.28	Stop	4.52	Slow ahead	5.21
Stop	4.28½	Slow ahead	4.53	Full ahead	5.21½
Slow ahead	4.29	Stop	4.54	Stop	5.22
Stop	4.29	Slow ahead	4.57	Full astern	5.26
Slow ahead	4.29½	Stop	4.59	Stop	5.26½
Stop	4.30½	Slow ahead	5.1	Half ahead	5.27
Slow ahead	4.32	Stop	5.4	Stop	5.27
Stop	4.32	Slow ahead	5.4½	Finished with engines	5.44

The American Bureau of Shipping has under preparation a set of rules to govern the construction of river, harbor and canal craft, with a view of taking up the classification of same.

Diesel Electric Ferryboat for Service in San Francisco Harbor

The *Golden Gate*, which will be the first large automobile ferryboat in this country to be equipped with Diesel engine electric drive, is expected to begin operations in San Francisco Bay early in the coming summer. She will form part of a fleet of ferryboats operated by the Golden Gate Ferry Company, which will offer a fast service between Sausalito and San Francisco, to form a link between the northern and southern highway systems of the State of California.

The *Golden Gate* will have an overall length of 220 feet and a displacement length of about 207 feet. Her propelling equipment will consist of two 500 brake horsepower Werkspoor Pacific Diesel engines each directly connected to a General Electric Company 360 kilowatt, 250 volt, shunt wound direct current generator. The power from these generators will be delivered to two 750 horsepower, 500 volt, 145 to 180 revolutions per minute shunt wound motors, one on each propeller shaft. There will be a 35 kilowatt, 115 volt exciter direct connected to each engine generator and used to furnish power for lights, excitation and engine room and deck auxiliaries.

The boat will represent a radical departure in ferryboat construction, being the first double ended one where each propeller will be driven separately. The most economical method of propelling such a boat is to have the majority of the power concentrated on the propeller that is actually driving it. Electric drive is the only way in which this can be satisfactorily accomplished and still use the same prime mover for both directions of travel eliminating duplicate units for ahead and astern travel.

The flexibility of control which is a feature of Diesel engine electric drive has also been fully taken advantage of in this boat. She will be equipped with Ward Leonard control, with stations in both pilot houses as well as in the engine room.

Motorship Californian of the American-Hawaiian Steamship Company

Sea Trials of the Motorship Californian

Thirteen Knots Speed Attained With Fuel Consumption of 0.31 Pound Per Indicated Horsepower

THE operating records given below, taken during the engine builder's trials of the American-Hawaiian Steamship Company's motorship *Californian* on May 1 and 2, offer an excellent opportunity to study the possibilities of American-built motorships of large size.

A complete description of the *Californian* was given in the February issue of MARINE ENGINEERING AND SHIPPING AGE and only the general details will be repeated here. The vessel was built at the yard of the Merchant Shipbuilding Corporation, Chester, Pa., and all machinery, both main and auxiliaries, at the yard of the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa.

In general, the *Californian* has the following characteristics:

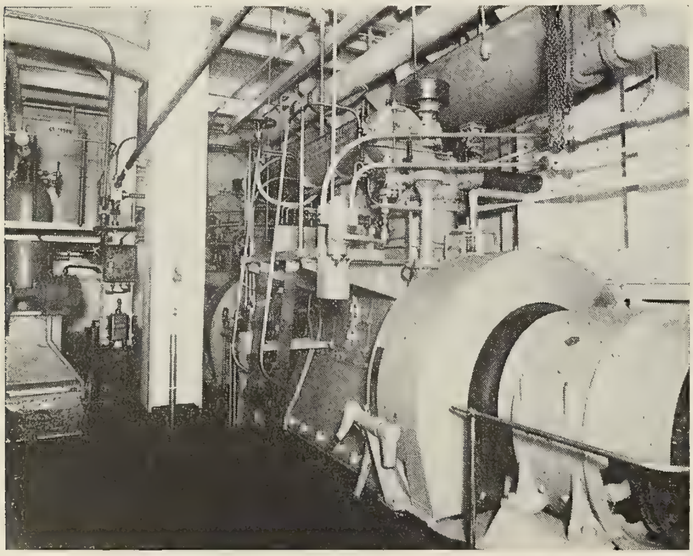
Length, overall	461 feet 7½ inches
Length, between perpendiculars	445 feet
Breadth, molded	59 feet 8 inches
Depth, molded to shelter deck	39 feet
Draft, loaded	28 feet 6 inches
Draft, light	10 feet 7 inches
Block coefficient	0.76
Midship section coefficient	0.986
Longitudinal coefficient	0.77
Speed, loaded, knots	11.5
Cruising radius, nautical miles	25,000
Framing	Transverse
Class	✠ 100 A.1. Lloyd's

The propelling machinery consists of two four-cycle Diesel engines built in accordance with the Burmeister and Wain system, having a total of 4,500 indicated horsepower and a designed speed of 115 revolutions per minute. The auxiliary machinery includes four Diesel engines direct connected to Diehl generators, each operating at a speed of 300 revolutions per minute and delivering 100 brake horsepower.

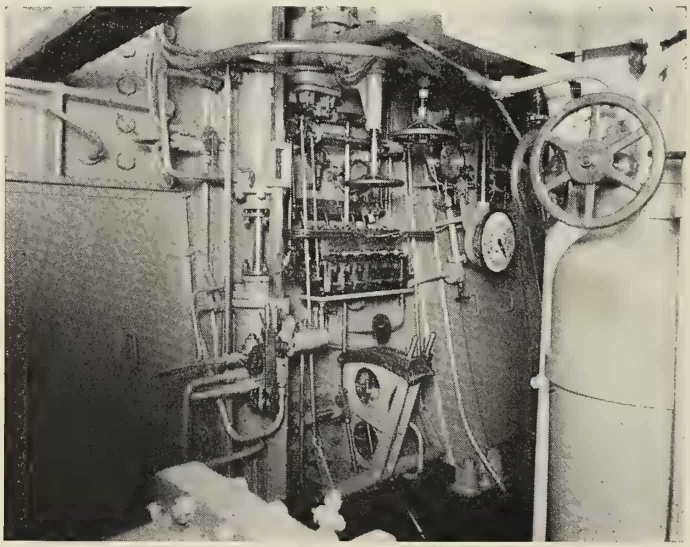
TESTS ON THE MEASURED MILE

An early start was made on the morning of May 1 from the yards of the Cramp Company and, after compass adjustments were made, three runs were carried out over the measured mile course with the following results:

Revolutions per minute, mean	114.62
Mean indicated pressure, main engines	82.8



65-Kilowatt Auxiliary Generator Set



Maneuvering Platform, Port Engine Room

Indicated horsepower, mean, main engines	4,330
Speed, knots, corrected for tide	12.57
Slip of propellers	5.4 percent
The maximum speed made over the mile course (uncorrected for tide) was	13.9 knots

On the second day a six-hour continuous run was made, which consisted in running 2½ hours out to sea and back and 3½ hours up the Delaware Bay and river. During this run, the draft of the vessel was 8 feet 3 inches forward and 18 feet aft, thus making the drag so great that the speed of the vessel was sensitive to the depth of the water. For this reason, and because it was necessary to follow the ship channel, the last two hours of the run were not considered in determining the consumption test, the amount of fuel oil used being taken only for the first four hours when the conditions of draft of the vessel were more uniform. In the open sea, the engines turned over at a maximum of 119.25 revolutions per minute without any change in the control of the engine. This engine speed corresponds to slightly over 13 knots. The results of the four-hour consumption test are as follows:

Oil consumption, main engines and one auxiliary engine	1,372 pounds
Indicated horsepower, main engines	4,417
Kilowatt load, auxiliary engine	50
Revolutions per minute, mean, main engines	117.58
Corresponding speed from standardization runs	12.9 knots
Mean indicated pressure, at corresponding speed from standardization runs	82.13
Oil consumption per indicated horsepower, main engines, only (all purposes)	0.31 pound

During the first half hour of the run the consumption was 0.328 pound per indicated horsepower due to the fact that the engines were not yet warmed up and this amount increases slightly the mean consumption for the four hours. For the total six hours the results are indicated below:

Indicated horsepower, main engines	4,445
Revolutions per minute, mean, main engines	117.29
Mean indicated pressure, main engines	82.80

It will be seen from these figures that the mean revolutions per minute are lower and the indicated horsepower higher for the six hours than for the four hours due to the greater resistance to hull in the shallower water, as previously stated, during the latter part of the run.

After the four-hour consumption test was completed the power of the engines was increased slightly to give their normal mean indicated pressure, which is 85.6 pounds, corresponding to the designed indicated horsepower of 4,500 at 115 revolutions per minute with the following results:

Mean indicated pressure, both engines	85.3
Revolutions per minute, mean, both engines	118.26
Indicated horsepower, mean, both engines	4,610

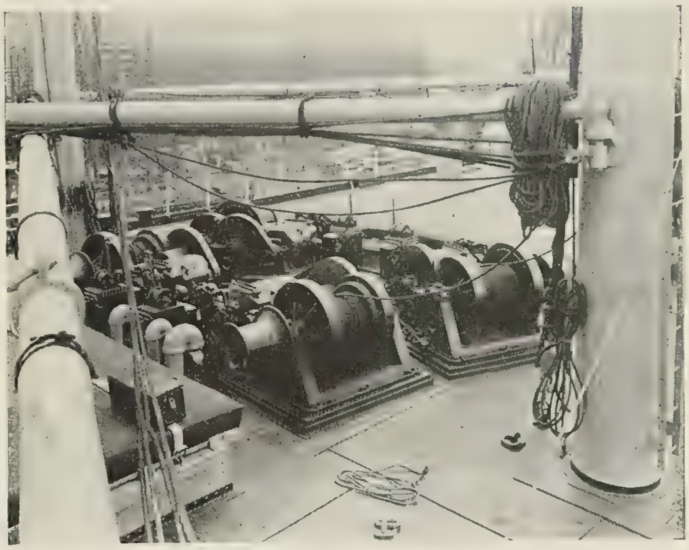
During this run, all inner bottom tanks were filled with oil as well as the peak tanks with water in order to have the screws completely submerged. Under these conditions, the mean draft was 13 feet 1½ inches taken in fresh water or 12 feet 10 inches mean, corrected to salt water, which corresponds to 6,750 tons displacement.

Final Adjustments Made to Machinery

After completion of the trials the *Californian* returned to the Cramp Company's yards, where a final examination of the machinery was made and adjustments carried out on the engines. The finishing coat of paint was also put on the engines, since this had been omitted until after the trials.

On May 5 the vessel was taken over by the American-Hawaiian Company and sailed for New York to be dry docked for cleaning and painting of the ship's bottom, which was not done before the trials.

On the run to New York a four-hour consumption test was made with the following results:



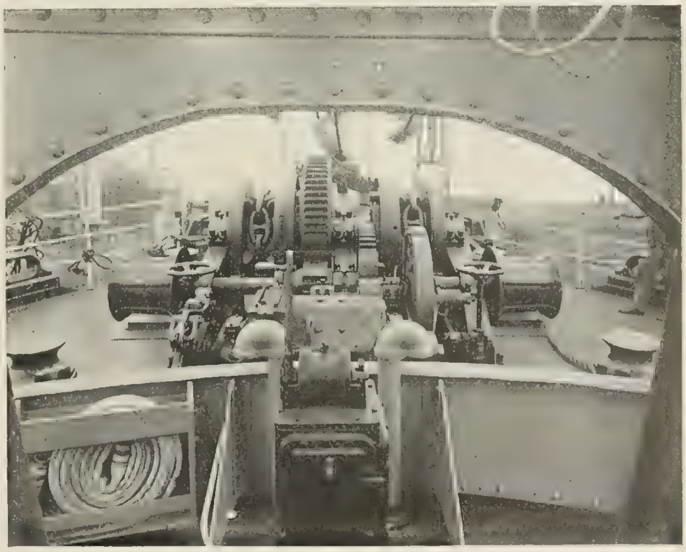
Group of Electric Winches at After Kingposts

	Port Engine	Starboard Engine	Mean
Revolutions per minute	115.95	116.25	116.10
Mean indicated pressure	85.65	84.90	
Indicated horsepower	2,267	2,256	4,523
Total gallons			738
Gallons per hour			184.5
Pounds of oil per hour			1,400
Oil per indicated horsepower, main engines, all purposes			0.309

The draft of the vessel on leaving the yard was 7 feet 10 inches forward, 18 feet 5 inches aft, or a mean of 13 feet 4½ inches which, corrected to salt water, was 12 feet 10 inches, the same as on the builder's trials.

All fuel tanks in the inner bottom were completely filled before leaving Philadelphia, there being a total of 9,426 barrels on board. On arrival in New York the draft was 8 feet 1 inch forward and 17 feet 6 inches aft, or a mean of 12 feet 9½ inches. The oil used on this trial was supplied by the Texas Company as it was in the case of the builder's trial, and had the following analysis:

Specific gravity at 60 degrees F.	0.913
Baumé, corresponding	23.5 degrees
Flash open cup	253
Fire	273
Viscosity Staybolt at 100 degrees F.	152
Sulphur	0.60 percent
Asphalt insoluble in naphtha	1.11 percent
B. T. U.	19,120

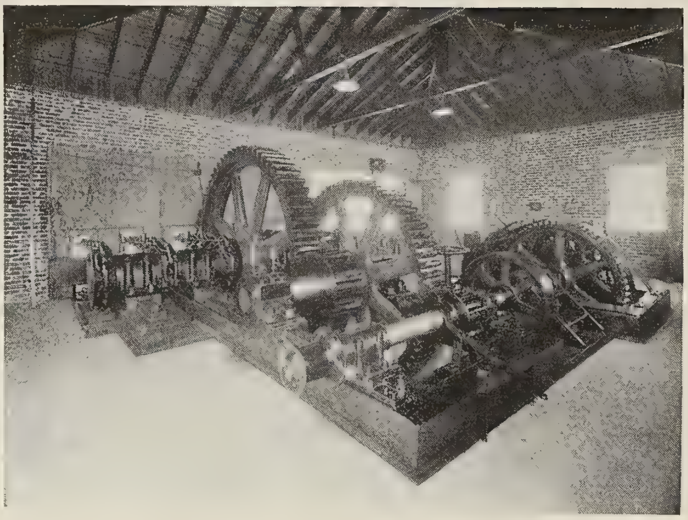


View of the Windlass on the Forecastle

It is interesting to note that the main engines were not run on the test stand in the builder's shops, as is generally the custom with this type of machinery, and the excellent results obtained on the trials justified this omission. The only adjustment required on the engines was in the fuel cam throws, which were quickly made since these were not integral with the fuel cams proper.

With the exception of the fact that there are four auxiliary Diesel generator sets instead of three, the machinery on the *Californian* is practically a duplicate of the motorship *William Penn*. The additional set was necessary because of the larger number of winches employed.

It is expected that the economy of operation will be improved after the ship has been in service for awhile when all bearings and liner surfaces are run in and the finer adjustments made to the fuel control. It is noteworthy that no bearings were raised during the trials nor adjustments made.



Hauling Machinery of 5,000-Ton Railway Dry Dock

5,000-Ton Railway Dry Dock at Norfolk

WITHIN the last year Colonna's Shipyard, Inc., Norfolk, Va., has put into operation a new railway dry dock with a lifting capacity of 5,000 tons weight, making it the largest railway dry dock on the Atlantic Coast. This dock, which is capable of handling the 10,000-ton deadweight class of ships, has added 40 percent to the dry docking facilities of the port of Norfolk.

The dock was designed and constructed by The Crandall Engineering Company, dry dock engineers, Boston, Mass., according to their standard designs. The track is of the four-way type, of timber construction, heavily bolted and braced, resting on a foundation of yellow pine piling driven to refusal and accurately cut to the correct gradient. The track is railed with flat steel plates. The cradle moves along this track supported on connected free rollers.

The cradle which actually carries the ship is of heavy yellow pine timber construction. The length over the keel blocks is 360 feet, which, with a fantail 20 feet long, gives an over-all length of 380 feet. The width between the over-all is 70 feet with 63 feet in the clear between the uprights. At mean high tide ships can be docked drawing 14 feet forward and 19 feet aft. It is built up aft by columns and heavy bracing so that the keel blocks conform to the usual slope of the ship's keel when in light condition, thus avoiding any distortion or stress to the ships.

On each side of the cradle are uprights supporting a docking platform conveniently located for handling lines and centering ships when being docked. On this platform are located the hand winches for pulling the bilge blocks against the ship. The bilge blocks are of patent releasing type, enabling one man to readily release and replace a bilge block under full load.

The cradle is operated by six hauling chains of open-link type attached to the cradle by an equalizing gear which assures the stress in the several chains being always the same. These chains are operated by a powerful hoisting machine, electrically operated, enabling a full capacity ship to be dry docked ready for repairs in 45 minutes. The machinery is of special design with heavy gearing and shafts. It is equipped with an automatic brake which stops the machine, in case the electric circuit is broken.

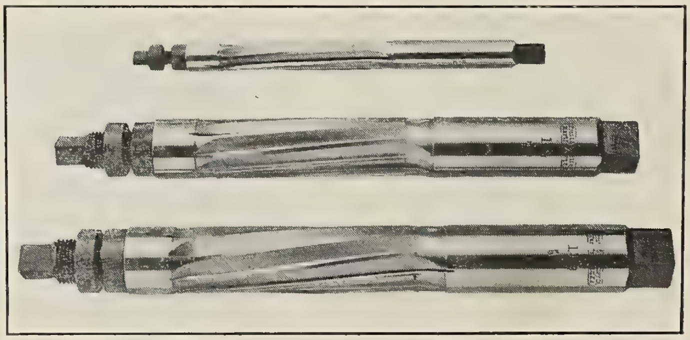
S. S. Larenberg on 5,000-Ton Railway Dry Dock at Norfolk

Spiral Fluted Expansion Hand Reamers

THE Pratt & Whitney Company, Hartford, Conn., has added to its line of small tools a spiral fluted expansion hand reamer. Expansion reamers have always found favor because of their long life and the adjustable feature that permits covering a range of sizes with one tool. Oversize or undersize holes can be reamed by simple adjustments. The advantages of the spiral flute with its free and clean cutting characteristics are obvious.

All reamers are equipped with lock nuts to hold the size and safety stops which prevent over-expansion and indicate positively when the maximum limits have been reached. Three sizes of spiral fluted expansion hand reamers are shown in the illustration, including ½-inch, 1-inch, and 1⅛-inch. These reamers are made in all the regular sizes.

The spiral flutes afford a distinct advantage in reaming holes having keyways in them. The straight flutes catch and bind on the edges, but the spiral continuous shearing cut rides safely over the corners assuring a hole cut to size.



Pratt & Whitney Spiral Fluted Expansion Hand Reamers

The Laponia, a New 8,200-Ton Ore Carrying Motorship Built by the Gothenburg Shipbuilding Company for the Grangesberg Oxelosund Company. Fourteen Similar Vessels Are On Order

Striking Features of Motorship Building in Europe

Remarkable Doxford Engine Development—More Motor Passenger Liners—Two Versus Four Cycle Diesels—Single Screw Motorships

By Our Special London Correspondent

THE fact that the construction of the Doxford opposed piston oil engine (perhaps the most interesting marine motor now built) is to be taken up at once by the Sun Shipbuilding Company of Chester, Pa., gives added interest in America to the noteworthy developments taking place in connection with this engine. Arrangements have also been made for it to be built at Workman, Clark and Company's Belfast works, and also by the Fairfield Shipbuilding & Engineering Company, on the Clyde.

It will be remembered that two Doxford engined ships have been completed and both of these recently completed their first voyage, that of the *Yngaren* (belonging to the Transatlantic Company) being a 6 months' trip practically round the world, while the first voyage of the *Dominion Miller,* owned by Furness, Withy and Company, was only between British and American ports. In the first engine, the fuel consumption was admittedly somewhat disappointing, working out at about 0.44 pound per brake horsepower hour. As a consequence the Doxford engineers set to work with the object of so modifying the design as to improve combustion and to reduce consumption. The result is that the engine of the *Dominion Miller,* the second ship, is apparently much more efficient and whereas the fuel consumption of the *Yngaren,* carrying about 9,300 tons at a speed of 11 knots, worked out at 11.6 tons daily, that of the sister ship, at nearly the same speed, was under 10 tons daily.

Fuel Consumption Reduced in Third Doxford Engine

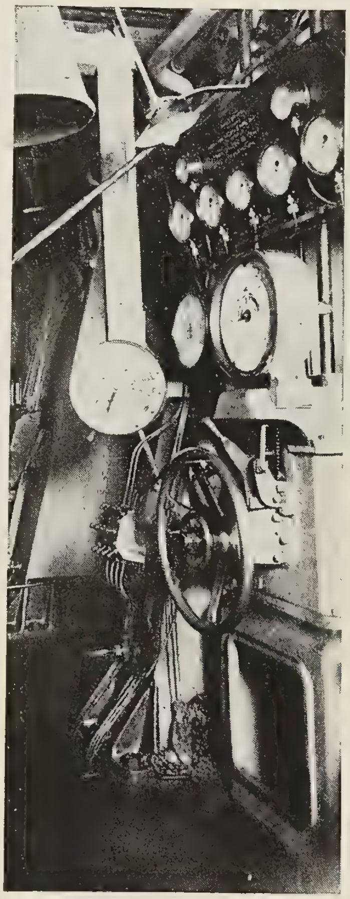
With the third engine that has just been built, and upon which special tests have been made, an even more satisfactory result is achieved and it is stated that fuel consumptions under 0.4 pound per brake horsepower hour are reached, these being quite equivalent to, if not superior to, those attained with four cycle motors.

These low consumptions have been attained by improvements in two directions. In the first place, the spray valves have been modified, and, secondly, the scavenging port system has been altered. By this means the fuel is sprayed in at a pressure of 8,000 to 10,000 pounds per square inch and meets with a volume of air at about 300 pounds per square inch pressure, whirling round with high velocity. Apparently the combustion is as perfect as is obtainable with any Diesel

motor, and it is stated that the exhaust temperature does not exceed 300 degrees. This is with a four cylinder engine of 3,000 indicated horsepower or about 2,700 brake horsepower and Doxfords believe that they have by no means reached the end of their experiments. They are now willing to guarantee six cylinder engines of 6,000 brake horsepower and it may not be long before motors of this size are constructed.

Popularity of Single Screw Ships

One of the most striking features of European motorship development is the increasing number of single screw vessels which are now being placed in commission. It appears that, once shipowners have overcome the idea that motorships are not as reliable as steamers, they prefer to have single screw craft, in spite of the fact that many Diesel engine manufacturers, and in particular Burmeister and Wain, are strong in their contention that a twin screw vessel can be quite as efficient from the propulsive standpoint as a single screw design. Moreover, it appears that large twin screw machinery is probably cheaper and occupies less space than a single screw plant on account of the fact that a single Diesel engine of say 4,000 horsepower is heavier than two sets of 2,000 horsepower. For the same propulsive efficiency a single screw craft must have machinery operating at lower speed than when two engines are fitted and this naturally reacts upon the weight and the cost.



Controls of the Doxford Engine

Nevertheless the shipowners' standpoint is that single engines are preferable on account of the smaller cost of upkeep and the fewer attendants required. Hence the great interest now being shown in motor vessels equipped with one engine. So far as reliability is concerned, there appears to be no reason against the single screw ship as instanced by the voyage mentioned above of the *Yngaren* when during six months no troubles of any consequence were experienced. The chief difficulty was in connection with the spray valve which had to be renewed about every four days, resulting in a stop of about one hour's duration in each case.

Among other single screw craft that have just been completed is Beardmore's first oil engined vessel, the *Pinzon,* provided with one of their Tosi type six cylinder Diesel engines of 1,250 brake horsepower. In this design some criticism was aroused on account of the fact that two air compressors were provided on the engine, each of which was capable of supplying all the injection air required. The builders' defense is that it is highly desirable on a single screw vessel to duplicate the injection system but whether shipowners, as a rule, will agree to this extra expense is somewhat doubtful.

Two Werkspoor engined single screw ships were also completed during April, one being the first motor vessel for the Netherland Steamship Company, the *Rhea,* provided with an 850 brake horsepower engine, and the other the *Segovia,* equipped with North Eastern Werkspoor machinery built by the North Eastern Marine Engineering Company, the leading reciprocating steam engine builders on the Tyne.

Two Cycle or Four Cycle Engines

A very heated controversy is now raging through the medium of the engineering and shipbuilding institutions and the technical press in Europe regarding the respective advantages of the two and four cycle types of Diesel machinery. Mr. Blache, the managing director of Burmeister & Wain, is the leading protagonist of the four cycle type and vehemently denies that this is ever likely to be displaced by the two cycle construction. In his opinion the high mean effective pressures claimed by the two cycle engine builders (100 pounds per square inch and upwards) are undesirable in Diesel cylinders and, if shipowners require to work at these pressures, four cycle engine builders would meet the same conditions. He therefore thinks that two cycle engines are rated too high and are unable to maintain their designed output at sea in the same way as is possible with a four cycle engine. Furthermore, he is of opinion that where port scavenging is adopted in two cycle engines—and this is well nigh universal—lubricating oil consumption must be excessive owing to its escape through the exhaust ports and he also objects to the employment of piston rings for a purpose other than that for which they are essentially designed.

The designers of the Sulzer engine retort that the characteristic of working at a high mean effective pressure is one of the peculiar advantages in the two cycle motor and that mean effective pressures exceeding 100 pounds per square inch can be maintained continuously. As a result the two cycle engine can be built more lightly and therefore cheaper than the four cycle design. Furthermore, they claim that, alone with two cycle engines, owing to the absence of exhaust valves, will it be possible to use cheap boiler oil instead of the more expensive Diesel oil. Again, the two cycle advocates aver that the limit has been reached in four cycle engine cylinder output, whereas with two cycle motors there is no reason why engines up to 12,000 brake horsepower in six cylinders should not be constructed.

Motor Passenger Liners

In spite of the shipbuilding depression, some interesting motor passenger liners are now being built, the largest being an Elder Dempster vessel for trade to West Africa, with accommodation of about 350 passengers.

This ship is over 500 feet in length and is to be provided with twin screw Burmeister & Wain machinery, built by Harland and Wolff, of 6,500 indicated horsepower, giving a speed of 13½ knots. She will, when completed, be the finest motor liner afloat and it is not unlikely that, should the clouds now hanging over the shipping industry lift, further vessels of a similar type will be laid down.

A sister ship to the *Domala,* the first motor liner for the British India Steam Navigation Company, is under construction on the Clyde and will be placed in commission before the end of the year, while the North German Lloyds are about to lay down a 9,000-ton passenger ship for trade between Germany and America. This will be a vessel of the intermediate class with a speed of 12½-13 knots and in it will be installed four cycle engines of about 6,000 horsepower.

Portland Cement Specifications Advanced to American Standard.—The "Specifications and Tests for Portland Cement," for which the American Society for Testing Materials is sponsor, have been advanced to the full status of "American Standard" by the American Engineering Standards Committee. These specifications were first approved by the A. E. S. C. as "Tentative American Standard" in 1919.

© New York Shipbuilding Corporation

200-Ton Hammerhead Fitting Out Crane on Pier 7 at the South Yard of the New York Shipbuilding Corporation

Two-Hundred-Ton Fitting Out Crane at Camden Yard

Details of Construction and Operation of Huge Hammerhead Crane Installed at South Yard of New York Shipbuilding Corporation

To provide for the installation of heavy weights such as boilers, guns, armor, turrets, engines, etc., in ships afloat, the New York Shipbuilding Corporation, Camden, N. J., through its civil engineer, Mr. E. H. Sapp, worked out the basic features of design for a 200-ton hammerhead electrically operated fitting out crane for installation at the head of Pier 7 at its South yard. The detail design and construction of the crane were carried out by the Wellman-Seaver-Morgan Company, of Cleveland, O.

The addition of this crane gives the New York Shipbuilding Corporation the most comprehensive crane system of any industrial plant in the country. Exclusive of the locomotive cranes, the yard is now equipped with 115 cranes well distributed among the shops, storage yards, ways and outfitting piers. They vary in size from those with a capacity of 1½ tons in the joiner shop through the 35-ton gantries on the outfitting piers and the 80-ton overhead traveling crane in the storage yard to the 100-ton overhead crane which serves the main covered unit of five double ways and wet slip, and the new 200-ton hammerhead crane.

The new hammerhead crane consists of a stationary self-supporting tower carrying a vertically rotated mast on the top of which a horizontal boom is securely connected. Normally five distinct motions are provided, viz., main hoist, main hoist trolley travel, auxiliary hoist and auxiliary hoist trolley travel and boom slewing.

The main hoist is made up of two units designed to operate as one unit when lifting the maximum load. The main hoist trolley travel is also made up of two units designed to operate as one unit when handling the maximum load. By removing the main lifting beam that connects the two main lifting blocks and the shifting of two jaw clutches (one connecting each of the two units of the main hoist and the main hoist trolley travel) each hoist unit can be operated independently, allowing the handling of loads up to 200,000 pounds with only one of the units in operation. The shifting of these jaw clutches is accomplished by the operation of hand levers located in the machinery house. Each of the above motions is operated by independent motors controlled from the operator's cab.

The crane has a capacity for handling any load up to 400,000 pounds at a maximum radius of 85 feet and 60,000 pounds at a maximum radius of 125 feet from the center of the tower.

The various motions of the crane have approximately the following speeds:

Main hoist	400,000 pounds at 11 feet per minute
Main hoist (one unit)	200,000 pounds at 11 feet per minute
Main hoist trolley travel	25 feet per minute
Auxiliary hoist	60,000 pounds at 32 feet per minute
Auxiliary hoist trolley travel	100 feet per minute
Slewing motion with either maximum load at each maximum radii or the equivalent, (at 125 foot radius)	125 to 150 feet per minute

Principal Dimensions

The principal dimensions of the crane are as follows:

Maximum clear lift from top of foundation (200-ton hooks)	118 feet 0 inches
Maximum clear lift from top of foundation (100-ton hooks)	124 feet 2 inches
Maximum clear lift from top of foundation (30-ton hooks)	126 feet 4 inches
Lowest position of hooks below top of foundation	35 feet 0 inches
Minimum radius of hook from center of tower (main hoist)	30 feet 0 inches
Minimum radius of hook from center of tower (auxiliary hoist)	30 feet 0 inches
Total height of crane over all, about	164 feet 0 inches

The boom may be slewed in either direction for an indefinite number of revolutions.

Tower, Boom and Mast

The tower is rectangular and is constructed of rolled steel sections. A portal 22 feet high by 27 feet wide is provided on the two opposite sides of the base. At the top of this tower is a circular track ring in which the vertical mast supporting the boom is centered. This track ring also carries the main circular rack for rotating the boom.

The boom and mast are constructed of rolled steel sections. The forward end of the boom carries the runways fitted with A. S. C. E. section rails, upon which the two main hoist trolleys and auxiliary trolley travel. These runways are arranged with the two main hoist trolleys on the outside and the auxiliary hoist trolley in the center, allowing the auxiliary trolley to pass between.

The boom is extended to the rear of the tower forming a support for the counterweight and machinery house which contains the operating mechanisms. The boom and mast are carried by a heavy thrust bearing framed in the tower just above the main portal. The mast carries horizontal adjustable rollers so located that they roll against the circular T-rail provided on the track ring of the tower, thereby keeping the mast in its vertical position.

Main Hoist Mechanism

This mechanism is made up of two distinct units, each unit being made up of two drums driven by an electric motor through spur gear reductions. These drums are cast iron, machine grooved to receive a single hoisting line. The faces of the drums are sufficient to take the entire line without overwinding the rope. When the hook is in the lowest position there still are two complete wraps remaining on the drum. A jaw clutch controlled by a hand lever in the machinery house provides means for connecting these two units, making them operate as one unit when handling the maximum load.

The main hoist trolley travel mechanism is made up of two separate units, each unit being made up of one drum driven by an electric motor through suitable spur gear reductions. The drums are cast iron, machine grooved to receive two ropes, one winding on as the other pays out. A jaw clutch controlled by a hand lever in the machinery house provides means for connecting these two units, making them act as one unit when handling the maximum load.

Auxiliary Hoist

The auxiliary hoist consists of a cast iron drum, machine grooved to receive a single hoist line, driven by an electric motor through spur gear reductions. The face of the drum is sufficient to take the entire line without overwinding the rope. When the hook is in the lowest position there still are two complete wraps remaining on the drum.

Main and Auxiliary Hoist Trolleys

There are two trolleys for the main hoist. Each trolley consists of a structural steel framework carried on four double flanged high carbon steel track wheels. This trolley carries six cast steel sheaves 45 inches in diameter for the hoisting rope.

The hoisting blocks used in connection with these trolleys are of the four sheave type carrying a four pronged forged steel hook arranged to swivel on roller bearings. A structural steel lifting beam is furnished which is suspended from these hooks. This lifting beam in turn carries a four pronged forged steel hook arranged to swivel on a heavy roller bearing.

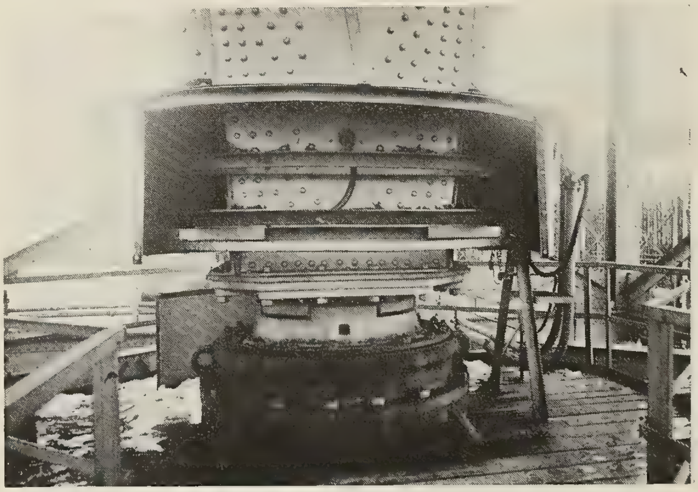
The auxiliary hoist trolley is made up of structural steel, traveling on four double flanged track wheels, and carries three sheaves. The lifting blocks in this case are of the two sheave type, 36 inches in diameter, carrying a four pronged forged steel hook arranged to swivel on a roller bearing.

The hoist and trolley travel ropes are reeved in such a manner as to maintain the hooks at a constant level when racking the trolleys. One and one-half-inch diameter rope is used for the main hoist, 1⅛-inch diameter for the auxiliary hoist, 1-inch diameter for the main trolley travel, and ⅝-inch diameter for the auxiliary trolley travel.

Slewing Motion

The mast and boom are rotated by two cast steel pinions meshing with a circular rack secured to the top of the tower. These pinions are driven by an electric motor through spur and bevel gear reductions. The vertical shafts are carried in a cast steel housing secured to the boom. To provide for equal loading on the main driving pinions, a differential unit is inserted in this mechanism.

A powerful foot brake is carried on the intermediate shaft of each hoisting unit, which is of sufficient power and so proportioned that the maximum lifted load may be held or lowered through these brakes in an emergency. The slewing



Step Bearing at Bottom of Vertical Mast, with Cover Over Electrical Conductors Partially Removed

Interior of Machinery House Looking Toward Boom

mechanism is provided with a similar foot brake, which is of sufficient power to hold the boom against a wind load of 10 pounds per square foot and will permit the boom to drift slowly when the wind pressure exceeds 20 pounds per square foot. These brakes are provided with latches, by means of which the brakes may be set and held in any position. The bands are lined with asbestos brake lining.

Electrical Equipment

The electrical equipment is designed for a voltage at the machine of 230 volts direct current, and will operate satisfactorily at a slightly higher or lower voltage. All master controllers are located in the operator's cab. Magnetic switch controllers are located in the machinery house, adjacent to the motors.

The motors are of the Westinghouse Electric & Manufacturing Company's make, series wound, mill type, totally enclosed, with fireproof insulation and armature shaft extensions on both ends. The motors are of the following approximate horsepower, based on ½-hour rating:

Main hoists	2 No. 80 M.C.	110 horsepower
Auxiliary hoist	1 No. 80 M.C.	110 horsepower
Main trolleys	2 No. 40 M.C.	27 horsepower
Auxiliary trolley	1 No. 40 M.C.	27 horsepower
Slewing	1 No. 60 M.C.	65 horsepower

The above motors are equipped with magnetic switch type controllers with drum type master switches, together with the necessary cast grid resistance. Those for the auxiliary and main hoists are arranged for dynamic braking, while those for the main and auxiliary trolleys and slewing are of the plain reversing type.

The main hoist master controllers are so arranged that, if the two main hoists are clutched together and used as a single unit, the master switches can be mechanically connected to operate as a single unit. The same is true of the main trolley master switches.

There is located in the operator's cab a protective panel equipped with a main line knife switch which disconnects all apparatus on the crane from the line. This switch is equipped with lock-out clips. Two single-pole circuit breaker contactors, one overload relay in the main circuit, one overload relay in one leg of each motor circuit, and no voltage relay control circuit fuses and a push button for resetting main circuit breakers are mounted on this panel. In this connection there is furnished an emergency switch, located within easy reach of the operator, by means of which he can stop all motions on the crane in case of emergency.

The operator's cab is located on the rotating boom at one side of the tower, giving the operator the best view of his work at all times.

Machinery House

The machinery house is located at the rear of the rotating boom and carries a runway for a hand operated crane. Special doors are provided at the rear of the house, opened and closed from the inside and so arranged that the hand operated crane can travel through them. The runway extends to the rear of the house a sufficient distance to permit of the raising or lowering of any part of the different mechanical units from the ground.

This mammoth crane was shipped by the Wellman-Seaver-Morgan Company in March, 1921, and put in operation at the south yard of the New York Shipbuilding Corporation in the summer of 1921. The total weight of the crane is 825 tons and of the structural material 625 tons.

(Photograph by Kadel & Herbert, N. Y.)

Battleship Maryland, Recently Commissioned Flagship of the Atlantic Fleet

The electrically propelled battleship *Maryland* was built by the Newport News Shipbuilding & Dry Dock Company. The electrical equipment was manufactured by the General Electric Company. The main particulars are: Length, 624 feet; beam, 97 feet 6 inches; draft, 30 feet 6 inches; displacement, 32,600 tons; shaft horsepower, 28,000; speed, 21 knots; main battery, eight 16-inch guns; secondary battery, fourteen 5-inch guns.

The Economic Efficiency of Merchant Ships*

Analytic Methods Show How Effect of Factors Entering Into Final Efficiency Can Be Accurately Assessed and the Results Applied to the Design and Management of Ships

By John Tutin

A MERCHANT ship is primarily designed, constructed and placed on service for the transport of the maximum amount of freight-earning cargo at a minimum of expense, and hence with maximum return to the owner on his outlay. At the same time it must be borne in mind that since there can be no dividend, if the vessel capsizes or a crew cannot be persuaded to man her, the complete test of a merchant vessel should be made on the following lines:

(1) Profit earning capacity.
(2) Safety and comfort of crew, and passengers, if any. (Governing factors are: Board of Trade regulations, together with metacentric height, reserve of buoyancy, factor of subdivision, capacity of boats, period of roll, etc.).
(3) Strength of the structure (as determined by the vessel's classification).
(4) Resistance to propulsion.

These four divisions are all interdependent and frequently conflicting, the underlying idea in design being to obtain a vessel of such proportions and characteristics as to give maximum potential profits. Divisions 2, 3 and 4 have hitherto received by far the larger share of investigation, as a glance at the list of papers contributed to this institution will show. The profit earning capacity (division 1) measures the economic efficiency as indicated by profit per pound of capital per annum, and has only been approached from the technical standpoint within the last two or three years, Mr. John Anderson, Mr. Alexander Urwin, Messrs. Baker and Kent and Professor Scribanti having contributed important work on this aspect of the question.† The subject, however, has by no means been exhausted.

Let us consider the derivation of an expression for efficiency (E) as indicated by the potential profit. We may write:

$$E = \frac{\text{Freight earnings per annum} - \text{charges per annum}}{\text{Capital invested}} \times 100 \ldots (1)$$

This equation is absolute, and no assumptions are necessary. We are in no such happy position when we begin to develop the equation thus:

$$E = \frac{36{,}500\,V\,[(f-t)\,C - x\,T - q\,k\,l\,\Delta^{2/3}\,L\,V^2]}{(L + n_L . V)\,P} - 100\,y \ldots (2)$$

which is Mr. Baker's formula expressed as a "percent per annum," where
C = cargo deadweight in tons,
T = net tonnage,
Δ = displacement in tons,
P = first cost in £,
V = sea speed in nautical miles *per day*,
f = freight rate in £ per ton,
t = sum of brokerage, management, loading, discharge, etc., in £ per ton,
x = tonnage dues in £ per ton for complete journey,
l = a factor given by I.H.P. = $l\,\Delta^{2/3}\,V^3$,
q = cost of fuel in £ per ton,
k = tons of coal per day per I.H.P.,
y P = sum of insurance, repairs, wages, depreciation in £,
L = length of voyage in miles,
n_L = number of days in port for loading, discharging, etc.

Referring to the formula, we see that:

$(f-t)\,C$ represents the earnings per voyage in respect of cargo carried.
$x\,T$ represents the port dues per voyage.
$q\,k\,l\,\Delta^{2/3}\,L\,V^2$ measures the cost of the fuel consumed per voyage.
$\dfrac{365\,V}{L + n_L\,V}$ is the number of voyages made in the year.

It will be noticed that the assumption is made that I.H.P. is proportional to $\Delta^{2/3}\,V^3$. This will only hold approximately for speeds below the limiting economical speed.

Further, C is defined as "cargo deadweight," and will vary therefore with V and L for the same ship, owing to variation in bunker weight. It would be convenient for purposes of differentiation to have C a constant quantity for the same ship. Let us therefore write, assuming a deadweight carrying vessel: C′ = load displacement — (light weight + stores). A slight error will still be present owing to the fact that stores will vary with V and L. We must now increase the cost of fuel by debiting it with the gross loss in freights due to the carriage of fuel. Further, it would be inaccurate to assume that just sufficient coal is carried to enable the vessel to reach her destination. We must allow a reasonable margin in case of emergency. Let this factor in respect of reserve coal be r (a working value is about 4/3), and note that normally the additional coal is not necessarily consumed, but is nevertheless carried at the expense of cargo.

Finally, there is the personal element and danger of the vessel not being continuously supplied with cargoes. Let us assume a factor ϕ to cover these and other contingencies. This factor will represent the proportion of her total time during which the vessel is actively employed, and for purposes of comparison may be taken as unity.

Applying these corrections, the formula may now be written:

$$E = \phi\,\frac{36{,}500\,V\,[(f-t)\,C' - x\,T - (q + r\,f - r\,t)\,k\,l\,\Delta^{2/3}\,L\,V^2]}{(L + n_L\,V)\,P} - 100\,y \ldots (3)$$

The expression is now in a comparatively general form, and it may be claimed for this process of synthesis that practically every element of variation is accounted for, thus:

L, n_L, x represent respectively the effect of route, port facilities and port charges.
k characterizes the type of engines.
l takes account of form $\left(\dfrac{1}{l} \propto \text{Admiralty coefficient}\right)$.
y is governed by the current rates of wages, etc.
r will indicate roughly the weather conditions prevailing on the particular route and the extent to which the vessel uses her own cargo-handling appliances.
ϕ will take into account the efficiency of the captain and managers, and the state of the freight market.

The important point to notice in this new expression is that the true cost of fuel is now $(q + rf - rt)\,k\,l\,\Delta^{2/3}\,L\,V^2$, whence it is clear that the virtual price of fuel is

$$q' = [q + r\,(f-t)] \text{ per ton} \ldots\ldots (4)$$

For example, with the nominal price of coal, say, 20 shill-

*Paper read at sixty-third session of the Institution of Naval Architects, London, April, 1922.

†Transactions Institution of Naval Architects, Vols. LX., LXII.; *Transactions Northeast Coast Institution of Engineers and Shipbuilders*, 1918; *Transactions Institution of Engineers and Shipbuilders in Scotland*, 1918; *Bulletin Technique*, 1919-20.

ings, with a virtual freight rate $(f - t)$ of 20 shillings, reserve coal factor 4/3, the virtual price of fuel works out at $q' = 46$ shillings 8 pence per ton.

A similar expression for virtual price of fuel in a bulk cargo carrier is:

$$q' = q + \frac{r\rho'}{\rho}(f - t) \ldots\ldots\ldots\ldots (5)$$

where ρ' is fuel density and ρ is cargo density (in cubic feet per ton).

Where fuel is carried in the double bottom in such a ship the virtual (and nominal) price is simply q.

In connection with equations (3), (4) and (5) the following points should be emphasized:

(1) Cost of fuel is dependent on the reserve coal carried and the freight rate, and hence—

(2) The importance of reducing r as much as possible, consistent with the possibility of a stormy passage.

A mathematical shipowner might get excellent results from the theory of probability in determining the best r for a given voyage.

(3) The value of r for coasting vessels, cross-channel steamers, and smaller craft generally can and should be made larger than for ocean steamers.

(*a*) Because f is smaller, and hence the relative importance of r is diminished.

(*b*) Because on a short voyage the probability of rough weather in relation to the number of days at sea is increased.

(4) The virtual price of fuel per ton is in general less for bulk cargo than for deadweight.

When $\frac{\rho'}{\rho}$ is unity the fuel costs are equal, but since coal stows at about 45 cubic feet per ton, and the limiting density for "bulk" cargo, $\frac{\text{bale capacity}}{\text{deadweight}}$, may be taken at about 55, we see that for the same virtual freight rate the virtual price of fuel is materially less.

(5) Note from equation (3) that total fuel consumption on a given voyage is proportional to V^2, and that, given a vessel with bunker capacity for L miles at V knots, her trading radius can be very considerably increased by reducing V to some smaller speed, say v.

The radius is in fact increased in the ratio $\left(\frac{V}{v}\right)$, and this without materially affecting profits (see later).

When cargoes are scarce this fact would appear to be of some importance, since it means greater scope for a vessel with restricted bunker capacity; but the use which could be made of this would depend of course on the flexibility of the main engines.

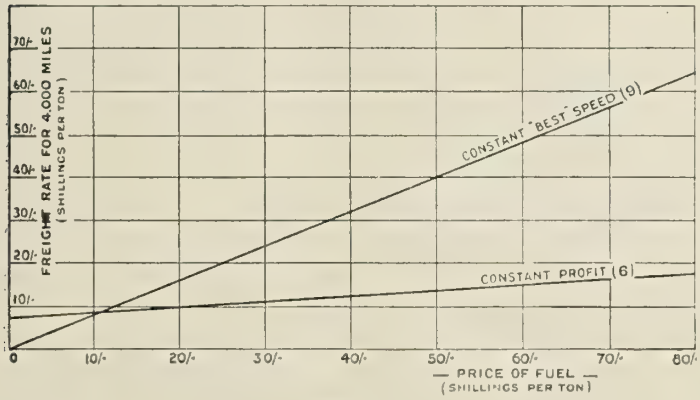


Fig. 1

These curves are drawn for assumed initial conditions:

$$f_0 = 10\text{s.}; \qquad q_0 = 12\text{s. 6d.}$$

and represent approximate values of freight rate and fuel price in order that—

(*a*) The "best" speed, which was initially the actual service speed, should remain constant.

(*b*) The initial efficiency or profit should remain constant.

N. B.—The ratio F/C required for curve (*b*) is taken for a 410-foot vessel (see Appendix).

Referring back to equation (3), we note that for a given ship designed for and trading on a given route, initially under external conditions specified by

$$f_0,\ q_0,\ \phi,\ x,\ y,$$

and making the reasonable assumption that changes in these quantities are confined to f_0 and q_0, the freight rate and fuel price, we can derive an instructive relation between these two factors if the owner's initial profit is to be maintained. Clearly this condition is expressed by:

$$fC' - (q + rf)\, k\, l\, \triangle^{2/3}\, V^2\, L = \text{a constant K}$$

And since $(k\ l\ \triangle^{2/3}\ V^2\ L) = F$, the fuel consumption in tons for the voyage, also K being determined by the initial values f_0, q_0, we obtain the result:

$$\frac{f - f_0}{q - q_0} = \frac{F}{C} \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where $C = C' - r\,F$ = net cargo capacity.

We deduce from this that if the initial profit is to be maintained, a curve of freight rate on a base of fuel price (Fig. 1) must be a straight line (for the given voyage), or, in other words, the ratio of increase in freight rate $(f - f_0)$ to increase in fuel price $(q - q_0)$ should be constant $\left(= \frac{F}{C}\right)$

Now the question naturally arises, what speed, i.e., what value of V for a given vessel, will make E a maximum? But before differentiating let us investigate any assumptions which would be implicit to that operation—clearly they are that all quantities other than V are constant.

We note that we have made C' constant, or nearly so, the slight variation of C' with speed owing to reduced stores, etc., as V is increased being offset by the increase in machinery weight, unless indeed we premise machinery of such flexibility that it can cope efficiently with wide variations of power.

Further, although displacement $\triangle$ at the beginning of a voyage may be assumed constant, yet owing to the fact that total fuel consumption on the voyage will vary as V^2, the displacement at the end of voyage will be by no means constant; in other words, the higher the speed the less the final displacement will be. Thus, as V is increased the mean value of $\triangle$ for the voyage is reduced. The effect will be to increase somewhat the calculated best speed, and the increase on the theoretical result will be greater the longer the voyage.

Differentiating now with respect to V, and equating the result to zero, we arrive at the result:

$$q'\, kl\, \triangle^{2/3}\, V^3{}_B \left(\frac{3L}{V_B} + 2nL\right) = (f'\,C' - x\,T) \ldots\ldots (7)$$

which gives the best speed, V_B, in terms of quantities which can be measured, calculated, or assumed for a given vessel (for working, see Appendix). We note that the best speed is not affected by wages y and capital P, nor by the "activity factor" ϕ, while it is dependent on all the other quantities in the expression for E.

A simpler equation for V_B can be derived thus:

Let the estimated "virtual" cost of coal for the whole voyage at a given speed, V_0, be $q'\ kl\triangle^{2/3}\ V^2{}_0L = M_0$.

Then the best speed is given by:

$$\frac{M_0 V^3}{L\ V^2{}_0}\left(\frac{3L}{V_B} + 2nL\right) = (f'\ C' - xT) \ldots\ldots\ldots (8)$$

In practice the best method of determining the best speed for a proposed vessel of deadweight C' (*ex* stores), and for given conditions of the shipping industry, is to construct an Efficiency—Speed curve based on equation (3). Such a curve can be of considerable guidance in the choice of a suitable speed. A specimen curve is shown (Fig. 2) for a 410-foot vessel.

The designed speed should approximate to as closely as possible, without exceeding, the "best" speed under the prevailing conditions. Before the best speed is reached there is quite a wide range of almost equally profitable speeds, whereas when the best speed is exceeded returns will very rapidly diminish. Conservatism with regard to designed speed cannot be too highly recommended, since, if freight rates fall more rapidly than the price of fuel, the designed speed may actually become the best speed while a similar but faster vessel is running at a loss. Similarly, if there is a spurt in freights, the vessel while maintaining her designed speed will still be able to run at an efficiency only slightly less than her sister vessel.

Summarizing results so far, we have obtained an expression for E and have shown how freight rate should vary, with fuel price, if a given ship is to maintain her initial E.

We have also obtained an expression for the best speed for a given ship under given initial conditions. How should freight rate vary with fuel price, if this best speed is to remain constant? It is obvious that a given speed might be the "best" speed over quite large variations in freight rate provided fuel can be obtained at corresponding prices.

Referring to equation (7), the condition for constant V_B can be written:

$$\frac{\partial V_B}{\partial f'}\,\delta f + \frac{\partial V_B}{\partial q}\,\delta q = 0$$

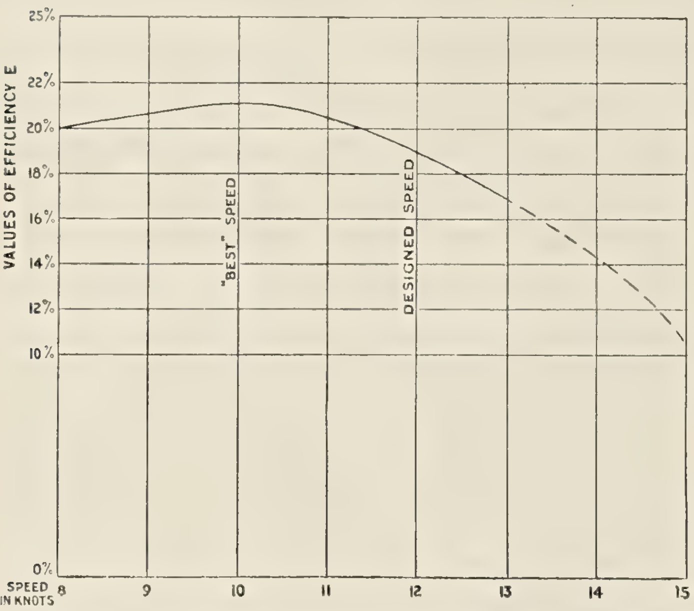


Fig. 2.—Efficiency-Speed Curve for a 410-Foot Vessel (For Details, See Appendix)

Length of voyage, 4,000 miles
(f) Freight rate, 10s.
(q) Price of coal, 12s. 6d.

The curve will be substantially the same for all values of f and q given by the formula:

$$\frac{f - f_0}{q - q_0} = \frac{f_0}{q_0}$$

$$\text{i. e. } \frac{f - 10\text{s.}}{q - 12\text{s. } 6\text{d.}} = 0.8$$

A direct calculation of the "best" speed under the same conditions, by formula (8), gave $V_B = 10.01$ knots.
i.e. the change in V_B due to changes δf and δq in f and q is zero; and on differentiating (see Appendix):

$$\frac{\delta f'}{\delta q} = \frac{f_0}{q_0}$$

(neglecting for our present purposes the effect of tonnage dues). A first approximation to the required relation is thus seen to be:

$$\frac{f - f_0}{q - q_0} = \frac{f_0}{q_0} \text{ (for constant "best" speed)} \ldots\ldots\ldots\ldots\ldots (9)$$

But an earlier formula gave:

$$\frac{f - f_0}{q - q_0} = \frac{F}{C} \text{ (for constant E)} \ldots\ldots\ldots\ldots\ldots (6)$$

In these formulæ, f_0, q_0 are initial and f, q are subsequent values of freight rate and fuel price, while F/C is the ratio $\frac{\text{Total fuel}}{\text{Cargo}}$.

An inspection of these formulæ reveals the fact that for a given increase in the cost of fuel, the increase in freight rate necessary to maintain the owner's profit is small compared with the increase which would be necessary in order that the normal service speed still remains the "best" speed. Since the normal tendency of the freight market will be to grant the shipowner more or less steady profits as indicated by equation (6) rather than (9), the necessity for a conservative designed speed becomes even more marked.

We may now proceed to the analysis of the efficiency formula and the determination of the influence which the various factors such as speed, displacement, tonnage, freight rate, length of voyage, etc., have on the final profit. In other words, we wish to measure the relative importance of these various factors in order that in a particular case we may see which factor or factors should receive most attention with view to maximum profits. Concentration on a factor in proportion to its relative importance should both in theory and in practice give improved results.

With this end in view, let us define "relative importance" of a given factor as "the percent change in the value of the expression for 1 percent change in the factor."

Thus, if $E = f\,(x_1, x_2, x_3 \ldots x_n \ldots)$, where f denotes "function of," then the relative importance of x_n is given by $\frac{\delta E}{E} \times 100$ for $\delta x_n = \frac{x}{100}$, and since $\delta E = \frac{\partial E}{\partial x_n}\,\delta x_n$, we have:

$$\text{R.I. of } x_n = \frac{\partial E}{\partial x_n} \cdot \frac{x_n}{E}$$

This method can be applied directly to the general expression for E [equation (3)], whence a formula for the relative importance of each factor can be derived. These formulæ and the corresponding numerical results for a 410-foot steamer are given in the Appendix. Having determined the relative importance of the factors in the final efficiency of the ship, quite a wide range of usefulness is opened out, since we may now

(1) Assess with a reasonable degree of accuracy the part each factor plays in the final efficiency, in relation to the other factors. From the sign (+ or —) of the relative importance we see whether the factor is "for" or "against"—whether efforts should be made to increase it or reduce it.

(2) Determine the resulting change in efficiency likely to accrue from any proposed changes in any factor or factors.

(3) In particular we can estimate closely whether ideas involving increased capital cost, and/or loss of deadweight, are worth adopting under current conditions.

If, for instance, the naval architect is considering the merits of a patent cargo-handling system, for which certain advantages over the normal type are claimed, he could make a rough estimate (see table on page 389).

(4) We can compare the merits of different voyages, routes or trades in a similar way, taking into account the freight rate offered, fuel costs at each end, port dues, etc.

(5) We can compare the efficiencies of two ships. Since E is so largely dependent on external factors, it is desirable that there should be some easily applied "test" of ships which is independent of these factors. By adopting a ratio method as indicated in the Appendix, a useful means of comparison is obtained.

Referring to the relative importance formulæ and numerical results given in the Appendix, it will be noticed that

while the formulæ given are only for the factors definitely entering into the efficiency formula, yet by means of the theorems enunciated in the Appendix the formula for almost any conceivable subsidiary factor can be derived. It must be borne in mind that theoretically a relative importance number only holds over a small range of variation in values owing to its being based on a partial differential coefficient. In almost all cases, however, except in that of speed, a reasonable degree of freedom may be taken in practice. The following notes on the Appendix results may be found useful.

Speed (1).—The relative importance of V is necessarily zero at the "best" speed, since $\frac{\partial E}{\partial V} = 0$, and above the best speed is negative and increases very rapidly. Below the best speed it is positive, but increases more slowly. See the E—V curve, Fig. 2.

Displacement (2).—This formula refers to changes of draft only, with consequent reduction in the weight of fuel consumed.

Estimated Effect on Factors: Factor	Percent	Relative Importance	(Product) Percent Increase in E	(Product) Percent Decrease in E
Time in port	— 10	— 0.573	5.73	—
Cargo handling expenses	— 10	— 1.4	14.00	—
First cost	5	— 1.733	—	8.66
Deadweight capacity	— 5	3.03	—	15.15
Total	—	—	19.73	23.81

First Cost (3), *Activity* (4), *and Number of Voyages per Annum* (21).—Necessarily of equal importance. First cost negative, ϕ and N positive.

Size (5).—The assumption is made that the size of the vessel is increased with proportional increases in $\triangle$, P, T, C. An interesting result is obtained, namely, that unless the vessel is being run at a loss increase of size will always mean increased efficiency, since when E is positive the relative importance of size is always positive. Since l diminishes with increase of size this effect is actually more pronounced.

M. Bertin (Assoc. Tech. Mar., 1913) shows, however, that there is a definite limit to increase of size, from structural considerations.

Deadweight (11).—As might have been anticipated, this is the most important factor. For example, under normal external conditions (A), a change of 1 percent in deadweight produced a change of no less than 3 percent in the efficiency. This illustrates the value of any means for reducing hull, machinery, equipment or fuel weights.

Freight Rate (8).—It might at first be thought that this should be of the same importance as deadweight, but f also occurs in the expression for the cost of fuel, and hence its importance is somewhat diminished.

Tonnage (12) *and Tonnage Dues* (16).—Necessarily of equal importance, and yet, judging by the numerical result, this importance is sometimes over-estimated.

Total Coal, Fuel Consumption and Form (13).—This result is interesting, since it shows that engine design and form are of equal importance; to be more precise, one may split up the factors l and k thus:

$$l = \frac{\text{I.H.P}}{\triangle^{2/3}\,V^3} \text{ where V = miles per day.}$$

$$\text{i.e. } \frac{1}{l} \propto \frac{\triangle^{2/3}\,V^3}{\text{E.H.P.}} \times \frac{\text{E.H.P.}}{\text{S.H.P.}} \times \frac{\text{S.H.P.}}{\text{I.H.P.}}$$

where

$$\frac{\triangle^{2/3}\,V^3}{\text{E.H.P.}} \text{ measures "form" efficiency}$$

and

$$\frac{\text{E.H.P.}}{\text{S.H.P.}} = \text{propeller efficiency}$$

= (screw efficiency in open) × (hull efficiency) × (relative rotative efficiency)*

and

$$\frac{\text{S.H.P.}}{\text{I.H.P.}} = \text{engine efficiency.}$$

Also

$$\frac{1}{k} \propto \text{(calorific value of fuel)} \times \text{(thermal efficiency of engines)},$$

and hence the product $k\,l$ is made up of the following component factors, each of equal numerical importance to k and l but of opposite sign (+):

$\frac{1}{kl}$ ∝ calorific value of fuel .... (*a*)
× thermal efficiency of engines .... (*b*)
× mechanical efficiency of engines .... (*c*)
× efficiency of thrust block and bearings .... (*d*)
× screw efficiency in open .... (*e*)
× relative rotative efficiency .... (*f*)
× hull efficiency .... (*g*)
× form efficiency .... (*h*)

The factors giving most scope for improvement would appear to be (*a*) (adopting liquid fuel); (*b*) (Diesel engines in place of steam); (*d*) (single collar thrust block); (*e*) (increased attention to propeller design).

In actual design it must be remembered that the factors which will best repay concentrated efforts towards improvement are those which afford the most scope for variation in association with their relative importance values; and in conclusion I submit that only by a study of the individual effect which each factor or group of factors has on the final efficiency can one hope to obtain clear ideas on what to make for in ship design.

APPENDIX I

RELATIVE IMPORTANCE FORMULÆ

General expression for efficiency:

$$E = \frac{\phi\, 36{,}500\, V\, [f'\, C' - x\, T - q'\, k\, l\, \triangle^{2/3}\, V^2\, L]}{(L + n_L\, V)\, P} - 100\, y$$

NOTE.

$f' = (f - t) =$ Virtual freight rate.
$q' = (q + r\,f - r\,t) =$ Virtual fuel price.
$k\,l\,\triangle^{2/3}\,V^2\,L = F =$ Total fuel consumption.

1. *Speed.*

$$\frac{\partial E}{\partial V} \cdot \frac{V}{E} = \frac{V}{E} \cdot \frac{36{,}500\,\phi}{P} \left\{ \frac{f'\,C'\,L - L\,x\,T - q'\,F\,(3\,L + 2\,V\,n_L)}{(n_L\,V + L)^2} \right\}$$

2. Displacement (for changes of draft only).

$$\frac{\partial E}{\partial \triangle} \cdot \frac{\triangle}{E} = \frac{-\triangle}{E} \cdot \frac{\phi}{P} \cdot \frac{36{,}500\,V}{L + n_L\,V} (\tfrac{2}{3} q'\,k\,l\,\triangle^{-1/3}\,V^2\,L)$$

3. *First Cost.*

$$\frac{\partial E}{\partial P} \cdot \frac{P}{E} = -\left(1 + \frac{100\,y}{E}\right)$$

4. *"Activity."*

$$\frac{\partial E}{\partial \phi} \cdot \frac{\phi}{E} = +\left(1 + \frac{100\,y}{E}\right)$$

5. *Displacement* (for changes of size with proportional changes in $\triangle$, P, T, C').

$$\frac{\partial E}{\partial \triangle} \cdot \frac{\triangle}{E} = \frac{\triangle}{E} \cdot \frac{36{,}500\,V\,\phi}{n_L\,V + L} \cdot \frac{1}{3}\,\frac{\triangle^{-4/3}}{a_3}\,q'\,k\,l\,L\,V^2 \begin{cases} C' = a_1\,\triangle \\ T = a_2\,\triangle \\ P = a_3\,\triangle \end{cases}$$

6. *Time in Port.*

$$\frac{\partial E}{\partial n_L} \cdot \frac{n_L}{E} = \frac{-n_L}{E} \cdot \frac{36{,}500\,V\,\phi}{P} [f'\,C' - x\,T - q'\,F] \frac{V}{(n_L\,V + L)^2}$$

7. *Wages, Depreciation, etc.*

$$\frac{\partial E}{\partial y} \cdot \frac{y}{E} = \frac{-100\,y}{E}$$

8. *Freight Rate.*

$$\frac{\partial E}{\partial f} \cdot \frac{f}{E} = \frac{f}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L\,V + L)\,P} (C' - r\,F)$$

9. *Length of Voyage.*

$$\frac{\partial E}{\partial L} \cdot \frac{L}{E} = \frac{L}{E} \cdot \frac{36{,}500\,V\,\phi}{P} \frac{\left\{ (n_L\,V + L)\,\frac{q'\,F}{L} + (f'\,C' - x\,T - q'\,F) \right\}}{(n_L\,V + L)^2}$$

*See G. S. Baker, *Ship Form, Resistance and Screw Propulsion*, page 170.

10. *Fuel Price.*

$$\frac{\partial E}{\partial q} \cdot \frac{q}{E} = \frac{-q}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L V + L)\,P} \cdot F$$

11. *Deadweight.*

$$\frac{\partial E}{\partial C'} \cdot \frac{C'}{E} = \frac{C'}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L V + L)\,P} \cdot f'$$

12. *Tonnage* (*Net*).

$$\frac{\partial E}{\partial T} \cdot \frac{T}{E} = \frac{-T}{E} \cdot \frac{36{,}500\,V\,\phi}{(L + n_L V)\,P} \cdot x$$

13. *Fuel Consumption* (per I.H.P.-hour).

$$\frac{\partial E}{\partial k} \cdot \frac{k}{E} = \frac{-k}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L V + L)\,P} \cdot \frac{q'\,F}{k}$$

14. *Admiralty Coefficient.*

$$\frac{\partial E}{\partial l} \cdot \frac{l}{E} = \frac{l}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L V + L)\,P} \cdot \frac{q'\,F}{l}$$

These are therefore of equal importance, since k and l cancel.

15. *Reserve Coal.*

$$\frac{\partial E}{\partial r} \cdot \frac{r}{E} = \frac{-r}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L V + L)\,P} \cdot f'\,F$$

16. *Tonnage Dues.*

$$\frac{\partial E}{\partial x} \cdot \frac{x}{E} = \frac{-x}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L V + L)\,P} \cdot T$$

17. *Total Freight Earnings.*

$$\frac{\partial E}{\partial (f'\,C')} \cdot \frac{f'\,C'}{E} = \frac{f'\,C'}{E} \cdot \frac{36{,}500\,V\,\phi}{(L + n_L V)\,P}$$

18. *Total Tonnage Dues.*

$$\frac{\partial E}{\partial (x\,T)} \cdot \frac{x\,T}{E} = \frac{-x\,T}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L V + L)\,P}$$

19. *Total Fuel Costs.*

$$\frac{\partial E}{\partial (q'\,F)} \cdot \frac{q'\,F}{E} = \frac{-q'\,F}{E} \cdot \frac{36{,}500\,V\,\phi}{(n_L V + L)\,P}$$

20. *Number of Voyages per Annum.*

$$\frac{\partial E}{\partial N} \cdot \frac{N}{E} = \left(1 + \frac{100\,y}{E}\right)$$

21. *Length of Voyage* (with proportional variations in freight rate).

$$\frac{\partial E}{\partial L} \cdot \frac{L}{E} = I_L + I_f \quad \begin{pmatrix} I_L = \text{R.I. of L, } f \text{ constant} \\ I_f = \text{R.I. of } f\text{, L constant} \end{pmatrix}$$

Theorem 1.—If x_n is a term in an expression (E) and of relative importance α, and z_n is a term in the expression x_n and of relative importance therein β, then the relative importance (ρ) of z_n in the expression E is given by:

$$\rho = \alpha\,\beta$$

Theorem 2.—If x_n, x_m are terms in an expression (E) and of relative importance α, α_1, and z_n is a term in both x_n, x_m and of relative importance therein of β, β_1, then the relative importance (ρ_1) of z_n in the expression is given by:

$$\rho_1 = \alpha\,\beta + \alpha_1\,\beta_1$$

Numerical Results.

The vessel considered is the third vessel in Mr. Anderson's series of five. Calculations for this vessel have also been made by Mr. Baker ("Best" Speed) and by Professor Scribanti (Depreciation), in addition to Mr. Anderson.

Deadweight	8,260 tons	Length of voyage (L)	4,000 miles
Deadweight (C')	8,110 tons	Freight rate (f)	10s per ton
Displacement (△)	11,520 tons	Cargo handling (t)	3s. 6d. per ton
Net tonnage (T)	3,120 tons	Tonnage dues (x)	1s. 3d. per ton
Sea speed (V)	288 miles/day 12 knots	Price of coal (q)	12s. 6d. per ton
Time in port (n_L)	6.8 days	Wages depreciation (y P)	1/7 P
First cost (P)	66,800 pounds	"Activity" (ϕ)	0.85
Total coal consumed (F)	901 tons	Total coal carried (r F)	1,081 tons (r = 1.2)

Relative importance factors are worked out for the following three sets of conditions:

f = 10s. q = 12s. 6d. E = 19.5 percent	A. Approximately "normal" relations between f and q. The designed speed (12 knots) is, however, somewhat in excess of the "best" speed, but in view of the mean displacement effect the difference is not so great as it would seem.
f = 23s. 6d. q = 12s. 6d. E = 126 percent	B. Abnormally high freight rate in relation to the fuel prices. Twelve knots is very nearly the "best" speed.
f = 10s. q = 20s. E = 12.2 percent	C. Abnormally low freight rate, the vessel is now running at a most uneconomical speed. Since under these conditions ϕ is probably much less than 0.85, the ship will presumably be laid up.

Formula		Relative Importance Factors A	B	C
11	Deadweight	+3.03	+1.44	+4.85
8	Freight rate	+2.62	+1.24	+4.22
3	First cost	—1.73	—1.11	—1.17
4	Activity	+1.73	+1.11	+1.17
—	Cargo handling costs	—1.43	—0.221	—2.29
13	Total coal consumption	—1.05	—0.291	—2.30
13	Form	—1.05	—0.291	—2.30
13	Fuel per I.H.P.-hour	—1.05	—0.291	—2.30
7	Wages, etc.	—0.733	—0.113	—1.18
2	Displacement	—0.700	—0.194	—1.54
10	Price of fuel	—0.647	—0.103	—1.67
6	Time in port	—0.573	—0.364	—0.714
15	Reserve coal	—0.403	—0.191	—0.645
5	Size of vessel	+0.354	+0.098	+0.775
1	Speed	—0.313	+0.053	—1.036
12	Tonnage	—0.23	—0.035	—0.368
16	Tonnage dues	—0.23	—0.035	—0.368
9	Length of voyage	—0.22	—0.103	—0.375
	Efficiency	19.5 perc't.	126.7 percent	12.2 p. ct.
	"Best" Speed (Knots)	10.01	13.2	8.0

The relative importance results may be assumed to hold approximately for any other values of f and q which are in proportion to the above, as per formula (6).

The variation in the order of magnitude under different external conditions shows that the details of design which should receive most attention will vary with the prevailing conditions of shipping.

Ratio Method

The merits of two ships can be compared as below, the advantage of the method being that while it is based on the results of the E formula, it is more readily performed, and at the same time a weak point in the vessel's efficiency can be at once detected; the relative importance values should, of course, be normal.

Ratio (Constant D.W. Denominator)	Values of Ratio: "Standard" or Basis Vessel	Values of Ratio: "Test" Vessel	Percent Difference from "Standard": +	Percent Difference from "Standard": —	Relative Importance Factor	Effective Differences: +	Effective Differences: —
First cost / Deadweight	.....	.....	.....	.....	First cost	.....	.....
Estimated fuel* / Deadweight	.....	.....	.....	.....	Total fuel	.....	.....
Net tonnage / Deadweight	.....	.....	.....	.....	Tonnage	.....	.....
Number of crew / Deadweight	.....	.....	.....	.....	Say, 2/3 R.I. of y	.....	.....
Rate of discharge, tons / Deadweight	.....	.....	.....	.....	Time in port	.....	.....
Ton-miles per hour† / Deadweight	.....	.....	.....	.....	Voyages per annum‡	.....	.....

*For a standard length of voyage at the design speed.
†This ratio equals speed in knots.
‡This factor estimates the influence of speed on the rate of earning profits without reference to its effect on fuel bill.

N. B.—Other ratios can be introduced: $\frac{\text{Machinery weight}}{\text{Deadweight}}$, $\frac{\text{Hull weight}}{\text{Deadweight}}$, $\frac{\text{Water ballast}}{\text{Deadweight}}$, etc.

Derivation of Formula (2)

1. Developing formula (1) we have:

$$E = \frac{\text{Earnings per voyage} - \text{Charges per voyage}}{\text{Capital}} \times \text{Number of voyages} \times 100$$

Earnings per voyage can be written as $(f - t)$ C.
Charges per voyage may be split up thus:

(*a*) Tonnage dues: x T.

(*b*) Fuel cost: q (weight of fuel consumed) $= k\,l\,\triangle^{2/3}\,V^3) \times \frac{L}{V}$

(*c*) Annual charges: Wages, depreciation, etc., totalling y P, and as a percentage of P: 100 y.

$$\text{Number of voyages} = \frac{365}{\text{Number of days for complete voyage}} = \frac{365}{n_S + n_L}$$

where n_S = time at sea, n_L = time in port.
But

$$n_S = \frac{L}{V},\quad (n_S + n_L) = \frac{n_L V + L}{V}$$

$$\therefore \text{number of voyages} = \frac{365\,V}{n_L V + L}$$

and thus formula (2) is derived as:

$$E = \frac{365\,V}{n_L V + L}\,[(f - t)\,C - x\,T - q\,k\,l\,\triangle^{2/3}\,V^2\,L] \times \frac{100}{P} - 100\,y$$

2. The fuel of total weight $r\,k\,l\,\triangle^{2/3}\,V^2\,L$ is carried at the expense of cargo, and thus the loss in freight earnings is $(f - t)\,r\,k\,l\,\triangle^{2/3}\,V^2\,L$ pounds. The fuel consumption, however, is only $k\,l\,\triangle^{2/3}\,V^2\,L$ and price q pounds per ton.

Net cost of fuel is therefore:

$$q\,k\,l\,\triangle^{2/3}\,V^2\,L + (f - t)\,r\,.\,k\,l\,\triangle^{2/3}\,V^2\,L \text{ pounds} = (q + r\,f - r\,t)\,k\,l\,\triangle^{2/3}\,V^2\,L \text{ pounds.}$$

Whence also virtual price of fuel consumed:

$$q' = (q + r\,f - r\,t) \text{ pounds per ton.}$$

3. Differentiating equation (3) for "best" speed, we have:

$$\frac{\partial E}{\partial V} = \frac{\phi\,.\,36{,}500}{P\,(n_L V + L)^2}\,[(n_L V + L)\,(f'\,C' - x\,T - 3\,q'\,F) - n_L\,V$$

(*Continued on page* 400)

Cement and Concrete for Shipbuilding Purposes—II

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials' point of view.

THE Tentative Standard Specifications determine the consistency of the mix by a slump test in the manner described in the "Tentative Specifications for Workability of Concrete for Concrete Pavements" of the American Society for Testing Materials, D62-20T. These specifications measure the consistency by the amount of slump or loss in height of a freshly mixed column of concrete in the form of a truncated cone 12 inches high, 8 inches in diameter at the bottom and 4 inches in diameter at the top. The Tentative Standard Specifications leave the amount of slump to the determination of the engineer on the operation, but fix a maximum slump of 6 inches for reinforced concrete for thin vertical sections and columns, and 8 inches for thin confined horizontal sections. The Shipping Board specifications require the water to be limited to the minimum that will permit the concrete to be worked into every part of the form, to embed the reinforcing completely and to produce a dense and watertight concrete. They adopted a slump test which consisted of filling a hollow cylindrical mold 6 inches in diameter and 12 inches long with the concrete to be used, setting this on end on a plate of glass or finished metal immediately after filling it, and withdrawing the mold with a slow vertical pull. They specified that under no circumstances should any concrete be used in the construction of the vessel that showed by this test a slump or drop exceeding 75 percent of the original 12-inch height of the concrete cylinder.

Proportions of Ingredients in Cement and Concrete

The Portland cement, fine aggregate and coarse aggregate in concrete should be such as to produce a material of the necessary plasticity that will have the desired quality and strength. The workability as determined by the slump test and the compressive strength at 28 days age are the principal factors. A very usual construction mixture is one part by volume of Portland cement to two parts of fine aggregate and four parts of coarse aggregate. A bag of Portland cement weighs 94 pounds and is considered to be one cubic foot.

The Tentative Standard Specifications include tables which for various sizes of coarse aggregate and fine aggregate give the proportions of the ingredients that at certain consistencies may be expected to produce concrete of the compressive strength at 28 days, for which each table is made up. These specifications, however, require that concrete in sea water or exposed directly along the sea coast shall contain not less than 1½ barrels (6 bags) of Portland cement per cubic yard in place; that concrete from 2 feet below low water to 2 feet above high water, or from a plane below to a plane above wave action, shall be made of a mixture containing not less than 1¾ barrels (7 bags) of Portland cement per cubic yard in place; and that slag, broken brick, soft limestone, soft sandstone or other porous or weak aggregates shall not be used.

Concrete below the ground line in alkali soils or water is required by the Tentative Standard Specifications to contain not less than 1¾ barrels (7 bags) of Portland cement per cubic yard in place.

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

The specified Shipping Board mixes were as follows:

Class A—1: 2/3: 1⅓
- 1 bag of Portland Cement
- 2/3 cubic feet of fine aggregate
- 1⅓ cubic feet of coarse aggregate

Class C—1: 2
- 1 bag of Portland Cement
- 2 cubic feet of fine aggregate.

The Class C mixture, which is cement or cement mortar rather than concrete, was allowed for the bilges and other equally difficult curved and warped surfaces where specifically authorized. All other structural concrete was specified to be Class A. In some cases the mix was made 1:⅚:1⅙.

Where joints have to be made in watertight construction on account of not being able to finish the work in one continuous operation, a heavy coating of neat Portland cement is required.

The mixes of cement for deck covering have been dealt with under that head, being generally 1:2. Classification society requirements for the protective cement coatings specified by them call for proportions of about 1:2.

Curing Concrete

The curing of concrete may be defined as the prevention of premature drying and it is essential to the development of high resistance to abrasion.

The Shipping Board required that for a period of at least two weeks after the forms were removed from any part of the concrete vessels the surface should be wetted down by sprinkling at least four times a day. In case of excessive heat they extended this to sprinkling the forms before removal after the concrete had been placed in them.

Materials for Waterproofing Concrete

As can be readily appreciated, the concrete used in concrete ship construction should be made as waterproof as possible, in order to keep water from passing through the relatively thin walls, in order to protect the steel reinforcing from corrosion and consequent destruction and in order to protect the concrete itself from possible action of certain elements in the sea water. Much can be done in this direction by careful grading and mixture of the solid materials and the avoidance of an excessive amount of water, because the formation of the colloids previously referred to gives to concrete a considerable degree of watertightness. The density and watertightness can also be increased by vibrating the forms while the concrete is being poured and skillful handling generally. Special waterproofing is, however, advisable for the main structural parts of a vessel and those that are exposed to salt water. Materials for this purpose are of two general classes—integral waterproofers and surface waterproofers.

Integral Waterproofing

Integral waterproofing materials are also of two general classes—those which are primarily designed to increase the density of the concrete and those which are primarily designed to prevent water from wetting the surfaces of the pores, thus destroying their ability to draw water in. It

would seem to be a very difficult undertaking to find a material that can be added to a concrete mixture which will fill up pores caused by the evaporation of the water in excess of that necessary to hydrate or set the cement, although materials which will increase the fatness of the mix and make it easier to compact will decrease the porosity. It is not so difficult, however, to find a material that will in a great measure make the concrete water repellent.

It is well known that a liquid is drawn up on any surface which it wets by what is called capillary attraction and that, if this surface is the inside surface of a tube, it will be drawn up a considerable distance. If the liquid does not wet the surface, it is actually depressed at the surface and in such cases a very small tube offers considerable resistance to the ingress of the liquid. The porosity of concrete is of the nature of very small tubes or ducts. A water repellent material that will coat the surfaces of the pores should therefore be of value as an integral waterproofer.

The aims sought by the manufacturers of integral waterproofing compounds in whole or in part are:

Maximum permanent repellency.

Constituents that will develop colloids, and thus as far as possible fill up the pores.

A material that can be uniformly distributed through the concrete by means of the water.

A material that will not react with the concrete materials and injuriously affect the compressive and tensile strength.

A material that will, like soap used in washing, reduce the surface tension of the mixing water, or lubricate the mix, and thus make the concrete more dense.

Absence of inert or inactive elements.

Freedom from any element soluble in water after the work is completed.

At least one of the manufacturers of integral waterproofing claims to have a compound which fulfills all of the above desiderata. It is in the form of a paste containing a combination of aluminum as an insoluble soap with palmitic or stearic acids, and also other elements. Other materials used by different manufacturers of integral waterproofing are sodium soap, stearate of lime, glue solutions, water glass and various oils.

Integral waterproofers that are largely or entirely pure silica are on the market and claim to increase the imperviousness of concrete by combining with the free lime which usually develops to a certain extent, thus fixing it and making it a permanent constituent of the concrete, whereas it would otherwise gradually dissolve out. Kieseguhr or diatomaceous earth and a product made from the pulverized shells of small sea animals are of this nature. Such materials were used on some of the Shipping Board's tankers in the nature of a lubricator, to fatten the concrete and thus make it more dense. They also aided in the density by being very finely ground. An efficient waterproofer of this character that does not introduce harmful results in other directions is also of value in preventing the destruction of surface coatings by the free lime. On some concrete ships exterior coatings containing oil have been attacked and destroyed by alkali salts brought to the surface, simply by testing tanks with water on the inside.

Builders of the concrete ship *Faith,* which was completed in San Francisco in 1918, are said to have made use of a material which relied on colloidal properties to plug up the pores.

Integral waterproofers should be thoroughly tested as to their value and their effect on the concrete. Some of them tested for the Shipping Board by the Bureau of Standards were found to be of little or no value in reducing the absorption of water, or were found to reduce materially the compressive strength of the concrete. The Tentative Standard Specifications state definitely that integral waterproofing compounds shall not be used, thus taking the stand that they are necessarily valueless or harmful in other directions, which is not the case.

Surface Waterproofing

Surface waterproofing is the method that has to date been most generally relied upon and a great variety of paints, oils and other compounds for this purpose are on the market. A coating of this kind besides being waterproof should be sufficiently elastic to remain intact, if fine cracks develop in the concrete, and should adhere well to concrete. If the surface is to be later coated with oil paint, the waterproofer should be of a nature that such paints will adhere to.

There are a number of proprietary mastic compounds for waterproofing using various kinds of tar and pitch, asphalt and elaterite, generally with asbestos fiber. They, however, will not penetrate the concrete. It has been found that short fibered asbestos is a valuable constituent of such waterproofing coatings, in assisting them to remain intact over the fine cracks which develop in the surface of the concrete, and that its quality has quite a bearing on the smoothness, consistency and covering power of the paint. The Bureau of Standards recommended that a sample of the asbestos to be used should be submitted by the paint manufacturer and that specifications should require it to be ground into the paint by passing at least twice through the grinders.

There are also compounds using paraffin, aluminium stearate, ammonia soap, etc. Oil paints will not adhere to a concrete surface waterproofed with paraffin.

Linseed oil, raw tung oil (China wood oil) and rosin oil penetrate concrete rapidly. The first mentioned is the most valuable as surfaces treated with this oil take coatings of oil paint better than when treated with the other oils. The oil first absorbed is undoubtedly converted into the lime soap of the oil by saponification with the free lime in the concrete. This is a water repellent material and has therefore waterproofing properties. Subsequent applications of the oil oxidize and form an elastic film which has good waterproofing properties, and this film is under the surface, where it is most desirable that it should be.

Perilla oil is another gumming oil which cures by oxidation rather than by evaporation of volatile matter and has high saponification value. It has been found by test to be a valuable surface waterproofer, and to penetrate concrete to a depth of 3/16 inch or more and make it repellent to the water in the manner explained under the head of integral waterproofing, thus partaking of the nature of such waterproofers. It has been found to be more resistant to the action of caustic lime than linseed oil and to furnish a good bond for succeeding coats of paint or varnish. To obtain best results such a coating should be applied as a saturated coat, i.e., in addition to the first general cover coat; subsequent touching-up coats should be applied to portions of the surface where the larger local porosity allows a quicker penetration. The saturation, however, should not be carried to the point where a film of the oil is left on the concrete surface. The oil should be received fresh from the manufacturer and stored in airtight containers until used. When exposed to the air in bulk it becomes somewhat fatty in time and when applied to the concrete gives a slow drying outer film. It may be expected to have in the long run a more waterproofing effect than spar varnish, since the original protective film of varnish, which does not penetrate, seems to soften and loosen with age.

Spar varnish makes a good waterproof coating and, when white lead pigment is ground into it in proportions of 40 to 45 percent of the pigment with 55 to 60 percent of varnish, a very serviceable, elastic waterproof paint with good body is formed. Such a paint is used for coating the pontoons of naval seaplanes. It is the gray enamel hereinafter referred to.

The Shipping Board tried out a process of coating the surface of the concrete with copper in the form of a metal spray. They found that the metal went into all of the nooks and crannies of the surface no matter how rough the surface

was; but that the particles of copper were somewhat oxidized and the coating was porous. They found also that the apparatus as made at that time would not stand up under continuous work and that it was therefore not satisfactory for large operations.

After careful research and the testing of a variety of special materials, some of which have nct been referred to here, the Shipping Board adopted spar varnish for the outside of the hull and all surfaces in cargo holds and engine and boiler rooms, and applied it on some of the ships. The results obtained on the outside of the hulls were unsatisfactory, due largely to the action of the lime in the concrete on the linseed oil in the varnish; and the results obtained on the inside of the hull were unsatisfactory owing to the practical impossibility of making it dry thoroughly in such spaces.

The coatings specified by them for the interior surfaces of water ballast and fresh water tanks and the shaft tunnel and all interior hull surfaces where water might accumulate, except cargo spaces, were a bituminous primer, C.S.9, and coating C.S.10, in accordance with the following specifications.

Bituminous Hull Paint—C.S.9

This shall consist of an asphalt base thinned with petroleum distillate. The asphalt base shall meet the following requirements:

Penetration at 77 degrees F. not more than 12 nor less than 8.

Melting point not less than 205 degrees F. nor more than 220 degrees F. (ring and ball method).

Soluble in cold carbon bisulphide not less than 99.5 percent.

Organic matter insoluble in carbon bisulphide not more than 0.2 percent.

Ash, not more than 0.3 percent.

A thin flake of material shall be capable of slow bending without breaking.

The completed bituminous hull paint shall contain approximately 60 percent of the thinner and it shall, when applied with a brush to a glass plate, dry at least to a tacky state in not more than one hour and shall be free from tackiness in not more than five hours. Also it shall be such that it may be applied satisfactorily while cold by means of a compressed air paint spraying device when worked with a pressure of 60 to 70 pounds per square inch.

Bituminous Thickened Hull Paint—C.S. 10

This paint shall be made by adding and grinding into the bituminous hull paint (Specification C.S. 9), approximately fifteen percent of extremely finely powdered silicious matter such as aluminum silicate, magnesium silicate, or a mixture of these, and approximately fifteen percent of short fibered inert mineral matter such as asbestos. No slaked lime nor calcium carbonate shall be used.

The thickened paint shall be applied with a brush and shall be such that a relatively thick paint film, which shall dry readily, will be obtained. This paint, therefore, shall have satisfactory brushing and spreading qualities.

After about two years of test and experimentation these were superseded by the following specifications C.S.37 and C.S.38, which were also extended to replace the varnish on the outside of the hulls and in the dry cargo holds.

Bituminous Primer—C.S. 37

This shall consist of a mixture of 60 percent base and 40 percent mineral spirits.

The base shall be a mixture of:

"Texaco 34"	90 percent
Rubrax grade "B"	10 percent

The Texaco 34 asphalt shall meet the following requirements:

Melting point (ring and ball method)	140 degrees F.
Penetration	45 degrees F.
Ductility	86 degrees F.

The Rubrax grade "B" asphalt shall meet the following requirements:

Melting point (ring and ball method)	243 degrees F.
Penetration	7 degrees F.
Ductility	0 degrees F.
Solubility in CS_2	99.9 percent

Bituminous Hull Paint—C.S. 38

This shall consist of a mixture of 50 percent base, 16.6 percent fibrous asbestos filler and 33.4 percent mineral spirits.

The base shall be a mixture of:

"Texaco 34"	90 percent
Rubrax grade "B"	10 percent

The asphalt requirements are as before mentioned.

The volatile mineral spirits in both specifications shall be a hydrocarbon distillate, water white, neutral clear and free from water. It shall have no darkening effect when mixed with basic carbonate white lead.

When 10 cubic centimeters are put in a glass crystallizing dish 2½ inches in diameter, and placed on a steam bath for 2½ hours, the residue shall not exceed .03 grams.

When tested according to the standard tests for paint thinners other than turpentine, prescribed by the American Society for Testing Materials, the flash point shall be not less than 29 degrees C. (85 degrees F.), in a closed tester, and in the distillation test, the first drop shall issue from the condenser at a temperature not below 129 degrees C. (265 degrees F.) and 97 percent shall distill below 243 degrees C. (470 degrees F.).

Good rules for the application of such coatings are: Before painting, all surface dust should be removed with a soft bristle brush and the surface should be as dry as possible and free from all surface water. The first coat of the thin paint, thinned as suggested before, shall then be applied and after drying it shall be inspected for brown and uncoated spots. These should be re-coated with the thin paint. About thirty-six hours shall elapse between the application of the thin paint and the first coat of the thick paint. This depends entirely upon weather conditions. The second coat can be applied with the paint sticky but in such condition that when rubbed with the hand no paint shall be removed. After the application of the second coat the paint should be allowed to dry twenty-four hours. The third is then applied and at least forty-eight hours should elapse before putting in the blocking. It is suggested that before putting in the blocking it be liberally dusted with powdered soapstone. All cement patches shall be allowed to cure at least three days and preferably longer before coating.

A heated asphaltic cement coating with a priming coat of the same mixture thinned with benzine or gasoline to the consistency of paint and applied cold was proposed for and the writer understands used upon the barges built by the United States Railroad Administration for service between New York City and Buffalo. It was submitted to the Bureau of Standards with a view toward ascertaining if the elasticity or life of the asphalt would be affected by the volatile oil in the priming coat; and it was their opinion that such would not be the case. The priming coat was necessary because a heated asphaltic cement coating applied direct to concrete will peal off of it upon cooling. The formula as proposed consisted of 100 parts of Bermudex refined asphalt mixed with 11½ parts of Craig oil flux at a temperature of about 300 degrees Fahrenheit.

One of the West Coast builders of the Shipping Board's concrete tankers recommended for the outside of the hull an application of magnesium fluosilicate, then a coat of perilla oil to full saturation, followed by a coat of a plastic concrete paint manufactured by one of the varnish manufacturers applied with a trowel, the surface being subsequently squeegeed off, leaving the hull very smooth and every open air or bubble hole in the concrete filled with a hard material that water did not appear to affect in the least. This was to be covered with two coats of Elaterite. It is not known that any concrete ships have been coated in this manner. Tests made by the Shipping Board of the Elaterite alone were unsatisfactory.

The Tentative Standard Specifications state that membrane waterproofing, consisting of a coating reinforced by fabric, felt, or similar toughening material, shall be used in basements, pits, shaft tunnels, bridge floors, retaining walls and similar structures where an added waterproofing protection is desired.

(To be continued)

A Simple Chronograph for Launching Observations

By John P. Comstock

IN the timing of a recent launch, a chronograph of extremely simple construction was used. The accuracy with which it recorded the speed of the ship is an excellent illustration of how a correctly designed apparatus may be made to serve a purpose, even though it lack expensive finish.

Formerly, launches at this yard have been timed in the usual manner, by painting a series of marks on the ship's side, and timing these with a stop-watch. Two observers stand at a sight, which is in line with the stern of the ship. One holds a stop-watch, on the crystal of which is pasted

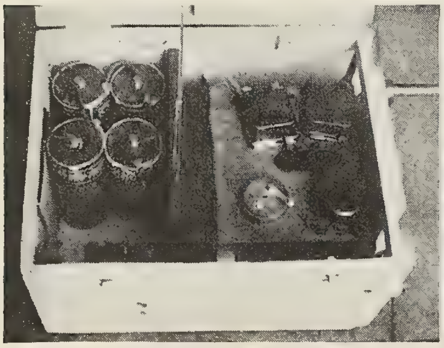


Fig. 1

Fig. 2

a narrow ring of paper, and the other observes the transit of the marks on the ship past the sight. The watch is started when the ship starts, and as each mark passes the sight, the observer taps the shoulder of the man with the watch, and the latter marks on the ring of paper the position of the watch-hand. As a check, a second pair of observers takes a duplicate record.

Errors to Which Stop-Watch Method Is Subject

This method is subject to the following personal errors, which, with the exception of the third, may be in either direction:

1. The error in estimating the instant of transit of the mark.
2. The error between the estimated instant of transit and the signal to the man with the watch.

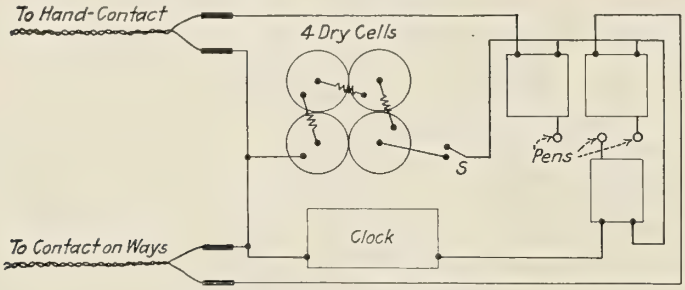


Fig. 3.—Wiring Diagram

3. The lag between the signal and the marking of the watch.
4. The error between the mark and the actual position of the watch-hand.

The start of the ship, in particular, is sure to be recorded too late and, in general, it cannot be said with certainty that the time recorded is within a half-second in either direction of the correct time.

During the first few moments of the launch, where the acceleration curve is most useful in determining the coefficient of friction, unmixed with water-resistance, the above method is especially unsatisfactory, because points cannot be obtained as close together as would be desirable for this rapidly changing portion of the distance-curve, and because the observers, not having gotten into the swing of their work, are especially inaccurate at the start.

Description of the Chronograph

These considerations led to the design of the chronograph shown in Fig. 1. It consists essentially of three pens, beneath which is drawn a strip of paper. The pens are held by ordinary electric bells, from which the gongs and their supporting arms have been removed. The balls on the hammers are replaced by clips to hold the pens. The vibrators are short-circuited with drops of solder.

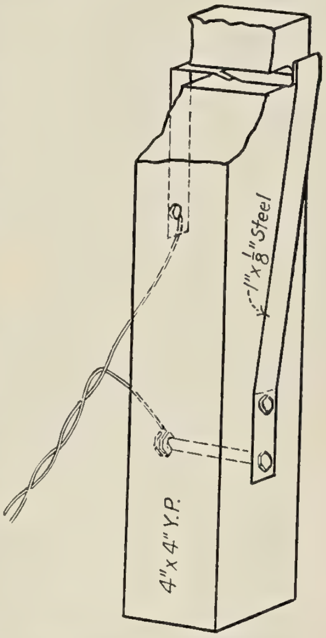


Fig. 4.—The Contactor

The middle pen is operated by the escapement of an alarm-clock, which closes a circuit, and so makes a jog in the line every half-second. One of the other pens is operated by a contactor on the ground-ways, which is closed momentarily as each of a series of stops on the sliding-ways reaches it. The third pen is operated by a contact-maker closed by hand at the sights before mentioned, as the marks on the ship's side pass the station. Thus two independent records are obtained. A wiring diagram is shown in Fig 3.

The clock which operates the middle pen is shown in Fig. 2. The works of an ordinary alarm-clock are mounted on a board, which also carries a copper shelf, to which is soldered a cup made from a revolver-shell. This cup holds a drop of mercury, and a small wire soldered to the escapement lever dips into the mercury at every stroke, thus closing a circuit. One wire is led to the shelf, the other to the frame of the clock. The clock is so made that the mercury contact occurs every half-second. Of course any clock may be used, after timing the beat.

The paper ribbon—an ordinary adding-machine ribbon

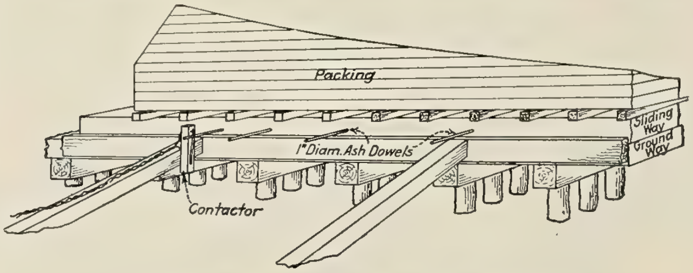


Fig. 5.—Arrangement on the Ways

was used—is wound from one roller beneath the pens onto another roller by a hand crank. The speed of the paper does not need to be exactly constant, for the number of seconds recorded between contacts will be the same, whether the paper is moving rapidly or slowly.

The Contactor

The contactor on the ground-ways is shown in Fig. 4. It consists of a spring of 1-inch by ⅛-inch steel, about 12

inches long, mounted on a piece of 4-inch by 4-inch pine. This is firmly fastened to a ground-way shore, far enough out to clear all obstructions on the sliding-ways, and as far aft as possible. When the spring is pressed home, it makes a rubbing contact with another piece of steel as shown. The

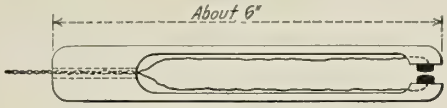


Fig. 6.—The Hand Contact-Maker

contact is made in the middle of the piece of pine, where it is well protected from flying grease from the ways, or from any other interference.

The contactor is closed by 1-inch diameter ash dowels, driven into holes in the sliding-ways, and long enough to provide for the greatest lateral movement that can occur. These dowels come against the contactor, close the spring, and then break off. The first one is placed just ahead of the contactor, so as to close it the instant that the ship starts. These dowels can be placed much closer together than can the marks on the ship's side, as the chronograph will record them as fast as they come. In this instance they were spaced so as to give contacts at roughly constant intervals of one second. The arrangement on the ways is shown in Fig. 5. The contact-maker used by the observer at the sights is shown in Fig. 6.

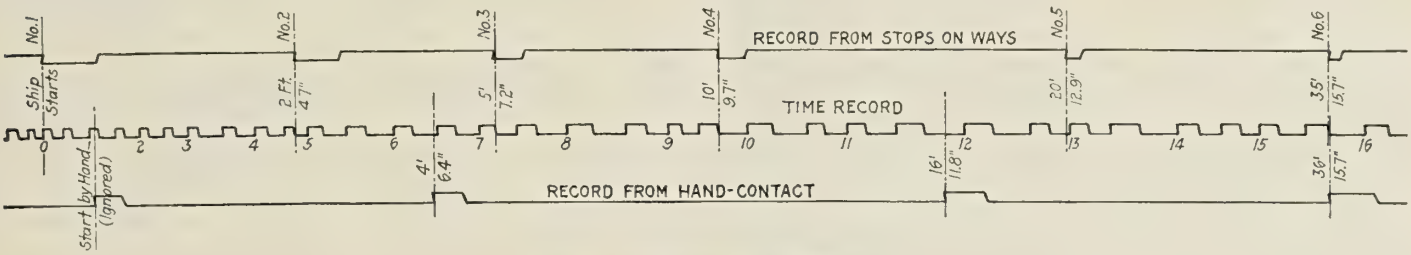


Fig. 7.—Section of the Ribbon

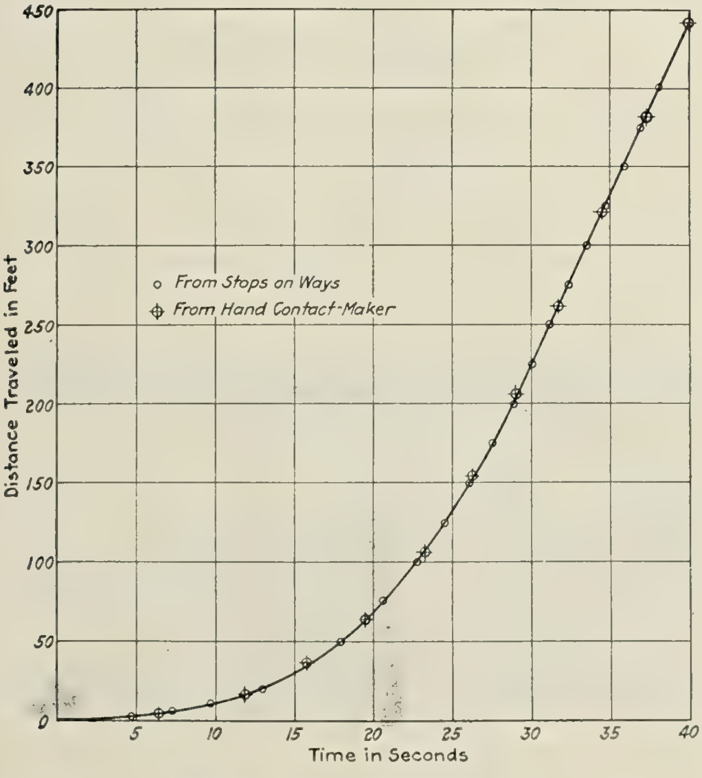


Fig. 8.—Time-Distance Curve

RECORD OBTAINED FROM THE APPARATUS

The ribbon obtained from the launching is shown in Fig. 7. The middle line is the time record, the upper line is the record of the automatic contact on the ground-ways, and the lower line is the record from the contact-maker operated by the observer. The time-distance curves from these data are plotted in Fig. 8. It is impossible to draw two separate curves. The points come much closer to a curve than any stop-watch record that has come to the writer's attention. In fact, it is difficult to put a satisfactory curve through the usual stop-watch data, and the resulting coefficient of friction does not deserve the confidence that can be given the coefficient derived from the curves shown here.

SUMMARY OF ADVANTAGES

To summarize the advantages found in using the chronograph as compared with the stop-watch method:

The work is done by two men instead of four.

The chronograph costs no more than one of the two watches.

Points on the curve can be obtained much closer together than can be marked on a watch.

Each of the records obtained is far more accurate than the stop-watch records—the automatic record being accurate probably to one-tenth of a second, and the hand-recorded time being accurate to about one-fifth of a second.

Unusual Opportunity for Young Men to Secure a Technical Education

ALTHOUGH at the present time the outlook for shipbuilding in this country is not very roseate, it will not long continue to be depressed and there will be ample opportunities for young men to find employment in naval architecture and shipbuilding. At the Webb Institute of Naval Architecture at Sedgwick avenue and 188th street, New York City, founded by the generosity of America's greatest shipbuilder, Mr. William H. Webb, and constituting the only educational institution in this country devoted solely to naval architecture and marine engineering, any young American, between the ages of 15 and 21, can secure a thorough education without any cost to himself whatever. This actually includes board and lodging throughout the entire course and represents one of the finest opportunities for ambitious youths that exist anywhere.

The young men must, of course, be of good character, and have a preliminary education equivalent to that given at the recognized high schools. No matter how many vacancies may exist, the standards are never lowered. They are such, however, that any ambitious youth may seek to obtain an appointment, if he is diligent and applies his attention to the necessary studies. Webb graduates are recognized at all the great shipbuilding centers as splendidly prepared, and they usually have no difficulty in obtaining good positions.

Full particulars as to the examinations, which are to be held in September next, will be furnished by the Resident Manager on application to the address above given.

Admiral Taylor, Chief Constructor of the United States Navy, to Resign on July 1

REAR ADMIRAL DAVID W. TAYLOR, chief constructor of the Bureau of Construction and Repair, U. S. Navy, has tendered his resignation to take effect July 1. Captain John D. Beuret has been nominated by President Harding to succeed him as chief constructor with the rank of rear admiral.

Admiral Taylor has been chief of the bureau for more than eight years and both foreign and American naval officers concede him to be one of the most distinguished technical officers that ever graduated from the Naval Academy. The design of modern warships of all navies has been more influenced by his work than by any other single individual.

Rear Admiral David W. Taylor, U. S. N.

As a student, Admiral Taylor held a record that has never been equalled for the general average of standing in all studies both at the Naval Academy and at the Royal College of Naval Constructors where he was sent under an agreement with the British Government to complete his professional studies.

It was largely due to his efforts that the model basin at the Washington navy yard was established. Through the use of this basin it has been possible through tests on hull models to determine accurately in advance of the actual construction of giant warships exactly what horsepower was needed to assure a given speed. It was while Admiral Taylor was at work at this basin that he worked out through a long series of tests with models the data for his books covering the subjects of resistance of ships and screw propulsion and the speed and power of ships which are international standard works today.

The high esteem in which Admiral Taylor is held in England was shown when the *Olympic* collided with the British cruiser *Hawk* in the Mersey river a few years before the war. The British Admiralty and the British Board of Trade were unable to come to a decision as to the responsibility for the collision and the United States Government was requested jointly by the British Admiralty and the White Star Line to send Admiral Taylor to England to give expert testimony. He went over there and explained the mystery by showing how the vast hull of the *Olympic* would set up drawing forces on the small hull of the cruiser when passing slowly by her.

Admiral Taylor has been a prominent member of the Society of Naval Architects and Marine Engineers. During the war he was a member and is still a member of the Advisory Committee on Aeronautics, chairman of the Joint Army and Navy Zeppelin Board and Army and Navy Aircraft Board. Hundreds of millions of dollars of contracts for new naval ships were virtually under his control during the war and it was also his bureau that developed the monster sea planes, including the *N.C.*-4, which successfully crossed the Atlantic ocean.

Thousands of Feet of Plywood Panels to Be Installed on the Leviathan

THE reconditioning of large vessels such as the *Leviathan* is now accomplished more rapidly than heretofore due to the fact that there is little or no delay in joiner work. The joiner work on most of the German liners taken over by this Government was made of plywood panels. Until recently no facilities were available in this country for doing this large panel work but during the war, in Grand Rapids and Ludington, Mich., were established the large plants of the Haskelite Manufacturing Corporation, where eight large hot plate presses were installed for the purpose of making large panels by the hot plate method using blood albumen glue, the glue which during the war ranked highest by Government test of all glues tested.

On the *Leviathan* there will be thousands of feet of large Haskelite panels, many of which will be 7 feet by 11 feet and larger. In the manufacture of panels by the Haskelite or hot plate method each panel is handled separately and given individual attention in its manufacture. In the large presses, shown in Fig. 1, there are three openings. In each opening one panel is placed at a time. The panels are subjected to heat of 212 degrees F. and over and a pressure up to 250 pounds per square inch. The actual making of a panel and the setting of the glue in these presses takes less than four minutes for each pressing on panels that are not in excess of 5 feet by 8 feet. On longer panels they are pressed a section at a time, the operation being continuous as the plies of wood are fed through the openings 5 or 8 feet at a time depending on which way the press is used.

The fact that these panels can be made up so quickly, are lighter in weight, more economical in space, more sanitary and more attractive, and can be installed so much more rapidly than tongue and groove bulkheads has made them popular in many of the largest yards on both coasts.

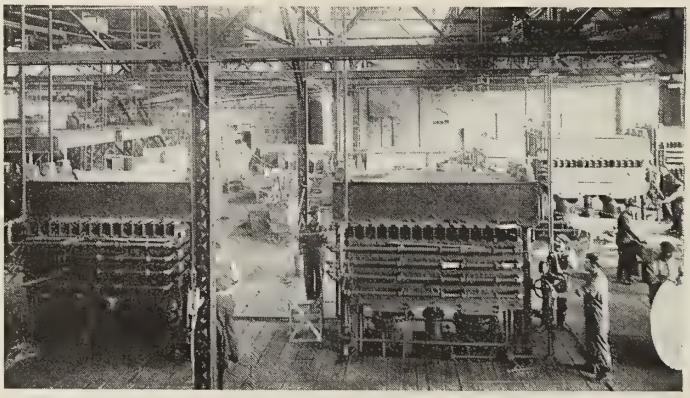


Fig. 1.—Hydraulic Presses at Haskelite Plant Used for Making Large Shipbuilding Panels

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Development of Shell Plating

Q. (1157).—In the development of shell plate in the mold loft by the triangulation method, the question as to which diagonal is the correct one to use has arisen. The triangulation as we work it is the expansion of the plate edge as picked up from the body plan, and the girth (not the true, but the unexpanded girth) with the diagonal.

A. (1157).—The method illustrated in your sketches is in general accord with the principles of the so-called simplified triangulation method. The use of this method should be confined to plates which have very little shape because of the correction for the girths along frames which must be

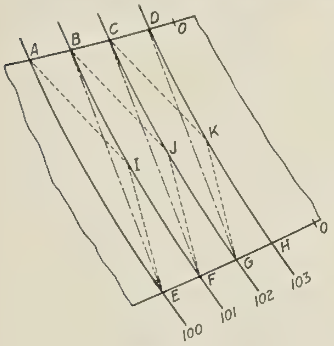


FIG. 1

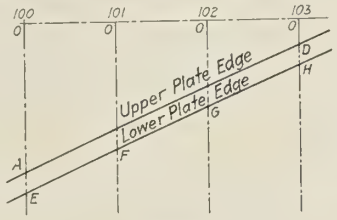


FIG. 2

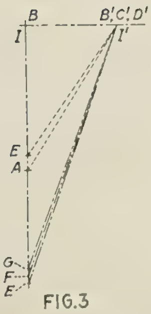


FIG. 3

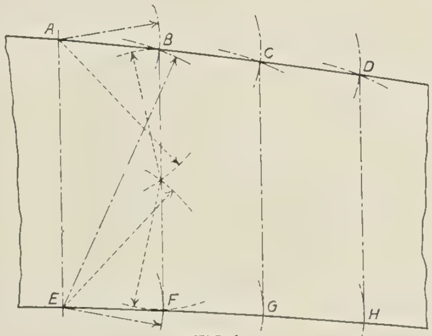


FIG. 4

introduced in connection with this method for plates having much bend and to which you refer as your last step.

You do not specify which diagonals you have in mind in your question. Instead of those shown, EB, FC, etc., it would, of course, give equally satisfactory results if we used AF, BG, etc.

The standard method of triangulation which is very accurate, even for plates having a fair amount of curvature, differs from that shown in its use of two rather than one diagonal. This method is shown, in so far as it differs from the simplified method, by dotted lines in the figures. In principle the two methods are the same but the use of the two diagonals EI and AI, instead of EB, eliminates the necessity of correcting for the girths along the frames. A development of this method is used for plates of pronounced curvature such as bilge plates.

Problem of the Hull and Its Screw Propeller

Q. (1160).—Referring to the April, 1921, number and Admiral Dyson's article, "Problem of the Hull and its Screw Propeller," on page 320 a formula is given for "the mean tip clearance." As I understand the article, this formula is for wing screws. What will be the formula for "tip clearance" for propellers of single screw ships?

On page 319, how is the "K" coefficient to be determined for a ship of Type 1; also for single screw type 3, twin screw type 2, and single screw vessels, type 2, twin screw type 3, if in each case the slip K. B. C. is .7 and the mean T. C. 2.5? I fail to understand how the result is to be read on the curve after the point is spotted for mean T. C., and slip K. B. C.

A. (1160).—The formula to which you refer is to be used only for Type 1 vessels having wing propellers. No formulas are to be used for other types of vessels or other arrangements of propellers.

In designing Type 2 single screw vessels and Type 3 deep draft twin screw vessels take their K value from Curve C_3-C_2, while Types 1 and 3 single screw, Type 2 twin screw and Type 3 twin screw shallow draft vessels take their value of K from Curve C_1-C_2.

For a Type 1 vessel having wing screws, plot your slip K. B. C.=.7 and Mean T. C.=2.5 on the chart referred to and it will be seen to fall between the "Curves of K" marked 1.2 and 1.175. The interpolated value would be approximately 1.18.

For all other types of vessel and number of screws the slip K. B. C. only is to be considered in design with the following results: K for single screw Type 3=1.35. K for twin screw Type 2=1.35. K for single screw vessels Type 2=1.093. K for twin screw Type 3, shallow draft=1.35. K for twin screw Type 3, deep draft=1.093.

Oil Heating Coils in Boiler Furnace

Q. (1161).—Why would not a coil of pipe within the furnace adjustable as to location to secure the proper temperature be better than steam heaters for an oil burning installation, and what would be its advantage or disadvantages?

A. (1161).—The placing of fuel oil heating coils in a boiler furnace has but few advantages and many serious disadvantages. Such an installation would be impossible to control as to temperature no matter where placed, as the intensity of the heat in the furnace will vary as the number of burners operating is increased or decreased. In case the heat became too intense or should there be for any reason a stoppage in flow of fuel, the oil would carbonize in the coils, making it impossible to start up again until the coils had been taken out and cleaned.

The coils would be out of reach of inspection and repair, both of which would have to be frequently made due to burning of the coils. The heater could not be by-passed because, should the oil be left in, it would carbonize, as stated above; and if drained off the coils would burn through. In case of burning out while operating, a stream of oil would be thrown into the furnace; which would probably cause the boiler to pant badly with perhaps serious results.

About the only points in favor of such a system would be the saving of space in the boiler room or in case there should be no available steam.

LETTERS TO THE EDITOR

Marine Boilers

In the April, 1922, issue is an interesting letter by Mr. F. W. Dean, of Boston, Mass., relative to marine boilers which does not accurately cover this subject.

Generally speaking, all reliable published tests to date show that the watertube boiler is more efficient than the fire tube type whether of Scotch marine design or externally fired as used in shore plants. This fundamental fact is further proved by the trend of modern development both ashore or afloat as is clearly shown by the increasing numbers of watertube boilers being purchased and installed as compared with the decreasing number of fire tube boilers being used. This, in the final analysis, is the best evidence of the superiority of the watertube boiler.

Referring specifically to the bent tube type boilers in the

Table I.—Results of Tests of Scotch Boilers by Emergency Fleet Corporation.

	1	Test number	37	38	39	40	41	42
	2	Date	1-21-21	1-22-21	1-24-21	1-27-21	1-28-21	1-28-21
	3	Location	Emergency-Fleet Corporation. Boiler Test Plant, Chester, Pa.					
	4	Duration ... Hours	3.000	4.063	3.004	4.006	3.021	3.043
Dimensions	5	Type of boiler	Scotch Marine. Foster superheater, air heater.			Scotch Marine with waste heat superheater		
	6	Heating surface ... Sq. Ft.	3,022.4	3,022.4	3,022.4	3,022.4	3,022.4	3,022.4
	7	Draft area through tubes ... Sq. Ft.	11.94	11.94	11.94	11.94	11.94	11.94
	8	Combustion space ... Cu. Ft.	544.7	544.7	544.7	588.4	588.4	588.4
	9	Superheating surface ... Sq. Ft.	774	774	774	774	774	774
	10	Air heating surface ... Sq. Ft.	1,220	1,220	1,220	1,220	1,220	1,220
	11	Burner	Coen	Coen	Coen	"Todd"	"Todd"	"Todd"
	12	Register	Howden forced draft front furnace.					
	13	Size of tip ... Ins.	.086	.051	.063	.073	.076	.086
	14	Retarders	Yes	Yes	Yes	Yes	Yes	Yes
	15	Atomizer. S = Slots	.....	.....	.....	2-S 1/32"	2-S 5/64"	2-S 5/64"
	16	Venturi—minimum diameter ... Ins.	.....	.....	.....	13	13	13
Fuel Data	17	Kind of fuel	Oil	Oil	Oil	Oil	Oil	Oil
	18	How fired	Forced draft	Forced draft	Forced draft	Forced draft	Forced draft	Forced draft
	19	Total amount of fuel as fired ... Lbs.	5,347	3,772	3,240	3,290	3,456	4,236
	20	Temperature oil at burners ... °F.	245	244	235	268	258	251
	21	Pressure oil at burners ... Lbs.	202	152	148	115	122	140
Analysis as fired	22	Moisture ... %	.3	.5	.2	.2	.2	.2
	23	Hydrogen ... %	11.32	11.17	10.99	11.46	11.57	11.57
	24	Carbon ... %	82.73	82.64	82.72	83.83	84.71	84.71
	25	Sulphur ... %	4.0	4.0	3.8	3.5	3.6	3.6
	26	Viscosity, Saybolt (187° and 122° F.)	Items 27-31 inclusive are taken from a collective sample.			280	280	280
	27	Baumé ... °				15.4	15.4	15.4
	28	Specific gravity				.963	.963	.963
	29	Flash point ... °F.				166	166	166
	30	Burning point ... °F.				234	234	234
	31	Heat value ... B.T.U.	18,324	18,325	18,326	18,390	18,392	18,382
Hourly Quantities	32	Fuel as fired ... Lbs.	1,782	928	1,079	821	1,144	1,392
	33	Fuel per burner ... Lbs.	594	309	360	274	381	464
	34	Fuel per sq. ft. heating surface ... Lbs.	.590	.307	.357	.272	.379	.461
	35	Fuel per cu. ft. combustion space ... Lbs.	3.27	1.70	1.98	1.40	1.94	2.37
Gas Data — Drafts and pressures	36	Furnace ... H_2O.-Ins.	+.41	+.06	+.06	+.19	+.47	+.88
	37	Below superheater ... H_2O.-Ins.	—.06	—.10	—.08	—.03	—.12	—.13
	38	Below air heater ... H_2O.-Ins.	—.07	—.09	—.09	—.11	—.09	—.06
	39	Base of stack ... H_2O.-Ins.	—.12	—.13	—.08	—.03	—.07	—.08
Analysis	40	Carbon dioxide (CO_2) ... %	13.6	11.5	12.3	12.3	13.5	13
	41	Oxygen (O_2) ... %	2.6	5.3	4.3	4.1	1.9	3.4
	42	Carbon monoxide (CO) ... %	.10	0	.06	.02	.12	.02
	43	Nitrogen (N_2) ... %	83.7	83.2	83.34	83.68	84.48	83.58
Tem-p's	44	Gas leaving boiler ... °F.	652	529	540	509	536	577
	45	Gas leaving superheater ... °F.	552	464	467	450	473	495
	46	Gas leaving air heater ... °F.	420	340	346	324	349	371
Wts.	47	Weight gas per lb. of carbon ... Lbs.	18.42	21.78	20.32	20.38	18.50	19.34
	48	Weight gas per lb. fuel as fired ... Lbs.	15.24	18.00	16.81	17.08	15.67	16.38
Air Data	49	Air pressure at fan ... H_2O.-Ins.	2.58	.72	.95	.6	1.42	2.5
	50	Temperature of atmosphere ... °F.	56	47	41	.....	41	46
	51	Temperature of boiler room near fan ... °F.	77	73	65	67	68	74
	52	Temperature of air at furnace ... °F.	230	207	201	215	209	224
	53	Barometer ... Ins. Hg.	30.18	30.19	30.10	30.41	30.28	30.27
	54	Relative humidity ... %	72	82	78	81	75	75
	55	Temperature boiler room—true ... °F.	.....	.....	.....	.....	.....	.....
	56	Radiant temperature of boiler room	.....	.....	.....	.....	.....	.....
	57	Smoke-Ringelmann scale	.....	.....	.....	.....	.....	.....
Steam and Feed Water	58	Boiler pressure (gage) ... Lbs. Sq. In.	174	166	174	174	171	172
	59	Temperature of water to boiler ... °F.	198	222	208	236	222	223
	60	Temperature of steam in calorimeter ... °F.	301	300	300	300	300	300
	61	Moisture in steam ... %	.59	.56	.64	.64	.61	.62
	62	Temperature of saturated steam ... °F.	377	374	377	377	376	376
	63	Temperature of superheated steam ... °F.	418	396	398	384	397	408
	64	Degrees superheat ... °F.	41	22	21	7	21	32
	65	Temperature of front of boiler bottom ... °F.	380	376	379	379	378	378
	66	Temperature of rear of boiler bottom ... °F.	384	378	384	384	383	383
	67	Factor of evaporation, steam from boiler	1.063	1.037	1.052	1.023	1.038	1.037
	68	Factor of evaporation, steam from superheater	1.089	1.052	1.067	1.028	1.052	1.058
	69	Pressure drop through superheater ... Ins. Hg.	6.9	2.0	2.6	1.6	2.8	4.3
Evaporation	70	Total weight of water fed to boiler ... Lbs.	76,430	57,716	49,456	50,603	52,250	64,262
Hourly Quantities	71	Actual evaporation ... Lbs.	25,477	14,207	16,463	12,632	17,296	21,118
	72	Evaporation corrected for moisture ... Lbs.	25,327	14,127	16,358	12,551	17,190	20,987
	73	Equivalent evaporation steam from boiler ... Lbs.	26,922	14,650	17,209	12,840	17,843	21,764
	74	Equivalent evaporation steam from superheater ... Lbs.	27,744	14,946	17,566	12,986	18,195	22,343
	75	Actual evaporation per sq. ft. heating surface ... Lbs.	8.43	4.70	5.45	4.18	5.72	6.99
	76	Equiv. evap. superheated steam per sq. ft. H. S. & S. H. S.	7.31	3.94	4.63	3.42	4.79	5.89
	77	Equiv. evap. steam from boiler per sq. ft. H. S. ... Lbs.	8.91	4.85	5.69	4.25	5.90	7.20
Economic Results	78	Actual evaporation per lb. fuel as fired ... Lbs.	14.30	15.30	15.26	15.38	15.12	15.17
	79	Equiv. evap. steam from boiler, fuel fired ... Lbs.	15.11	15.79	15.95	15.64	15.60	15.64
	80	Equiv. evap. steam from superheater, fuel fired ... Lbs.	15.57	16.10	16.28	15.81	15.91	16.05
Efficiency	81	Boiler and superheater based on fuel fired ... %	82.5	85.3	86.2	83.43	83.9	84.73
	82	Boiler based on fuel fired ... %	80.0	83.6	84.5	82.52	82.31	82.56

Heat Balance			B.T.U.	%	B.T.U.	%	B.T.U.	%	B.T.U.	%	B.T.U.	%	B.T.U.	%
	83	Heat absorbed by boiler and superheater	15,109	82.5	15,623	85.3	15,798	86.2	15,342	83.4	15,439	83.9	15,575	84.7
	84	Loss due to moisture in fuel	3	...	5	...	2	...	2	...	2	...	2	...
	85	Loss due to burning hydrogen in fuel	1,065	5.8	1,005	5.5	999	5.5	996	5.4	1,030	5.6	1,048	5.7
	86	Loss carried away in dry gases	695	3.8	566	3.1	585	3.2	492	2.7	568	3.1	621	3.4
	87	Loss due to carbon monoxide	61	.3	0	...	41	.2	14	.1	76	.4	13	.1
	88	Loss unaccounted for	1,391	7.6	1,126	6.1	901	4.9	1,544	8.4	1,277	7.0	1,123	6.1
	89	Heat in fuel as fired per pound	18,324	100	18,325	100	18,326	100	18,390	100	18,392	100	18,382	100

Berengaria, Leviathan, Great Northern, Northern Pacific and some of the "State" ships of the Shipping Board, the four ships mentioned have large tubes; namely, 2-inch, which if properly handled and fed with pure feed water are satisfactory for merchant marine service. The "State" ships built by the Bethlehem Shipbuilding Corporation at Sparrows Point, Md., have small bent tube type Yarrow boilers; namely, 1-inch and 1¼-inch. These tubes, while satisfactory in the Navy, have not proven satisfactory in the merchant marine as it is impossible to clean them internally with any present day known methods. The boilers of the *Great Northern* and *Northern Pacific* are a modified two-drum type designed by Mr. John Mitten, chief engineer, Wm. Cramp and Sons Ship and Engine Building Company, and installed by the Babcock & Wilcox Company.

The Emergency Fleet Corporation has tested out both Scotch and watertube boilers. A comparison of the two sets of tests does not show any superiority in efficiency for the Scotch boiler. In the case of the Scotch boiler tested by them it was fitted with a Foster waste heat superheater and a Howden type forced draft air heater. Adding the heat absorbed by these two auxiliary devices the efficiency of the Scotch boiler is as shown in the accompanying table of tests. So far as I know, these are the only reliable tests made of a Scotch marine boiler.

Any boiler steaming test that will not bear the careful analysis of a heat balance can hardly be considered reliable. It will be noted from the heat balance of the tests quoted that with the highest efficiency shown, namely, 84.3 percent, there was an unaccounted loss of less than 2 percent. In other words it is possible with an exceptionally careful testing crew, having all the known scientific apparatus available, to obtain approximately 86 percent efficiency from a Scotch boiler, a waste heat type superheater and an air heater. Some of the British tests shown in the table attached to Mr. Dean's paper have the impossible efficiency of 89.5 percent and therefore can hardly be considered reliable.

There are no known similar tests of a watertube boiler fitted with the waste heat absorbing devices which were used to increase the efficiency of this Scotch boiler. There are, however, reliable tests published of watertube boilers having efficiencies of over 84 percent without the aid of these auxiliary heat absorbing devices which are required by the Scotch boiler to equal the performance of the watertube boiler.

In the past, at relatively low pressures, there was unquestionably a field for the Scotch boiler. In the future, with the demand for increased economy, there will be little if any field for the Scotch boiler, particularly as increased economy necessarily means higher steam pressures.

Jos. J. Nelis, Secretary,
New York. Foster Marine Boiler Corporation.

Information Wanted

Joseph Wolff, chief engineer of the new White Star liner *Majestic,* has an important personal quest to take up in seeking a younger brother who dropped out of sight at Oakland, California, two years ago and has not been heard from since by his family, who live in England.

The man sought is Fred Wolfe—the brothers spell their surnames differently—aged 37. During the war he was employed as an engineer on the Red Star Line steamship *Lapland,* plying between New York and Antwerp. He left that occupation to engage in war work, which took him to Oakland, where he was employed as a machinist in a shipyard. His last address known to his brother was 426 26th street, Oakland.

Wolfe last communicated with his family in March, 1920, when he appeared to be in good health and spirits. He was always a dutiful father—he was a widower with two children—and had always communicated regularly with his people. When his letters ceased, his brother became anxious and wrote to Oakland, but without learning the circumstances connected with his brother's leaving there.

Chief Engineer Wolff is prepared to seek information of his brother through every possible source. Telegraphic information may be sent him care of *S. S. Majestic,* White Star Line, Pier 59 North River, New York.

NEW BOOKS

The Engineering Index, 1921. Size, 6½ by 9¼ inches. Pages, 584. New York, 1922: The American Society of Mechanical Engineers.

The current issue of The Engineering Index contains over 14,000 items referring to articles in some 600 engineering and allied technical publications published in 1921. In selecting these items the engineering staff of the American Society of Mechanical Engineers has reviewed the 1,200-odd periodicals, reports and other publications regularly received during the year by the Engineering Societies Library, New York, and which, it is believed, comprise the most complete collection of scientific and engineering publications in the world. The Index, therefore, gives to the engineer or scientist a key to the wealth of technical information published during the year. Each item contains the exact title of the article indexed; the author's name, if given; the name of the periodical in which the article appeared; the volume, number and date of publication; the page numbers and number of figures in the article; and a brief note concisely summarizing the contents of the article. The items are arranged alphabetically under main and sub-headings and carefully cross-indexed for reference purposes.

Waste in Industry. By the Committee of Elimination of Waste in Industry of the Federated American Engineering Societies. Size, 5¾ by 9 inches. Pages, 409. Illustrated by numerous charts and diagrams. Washington, D. C., 1921; Federated American Engineering Societies. New York, 1921: McGraw-Hill Book Company, Inc.

Representing the result of five months of intensive study, carefully planned and rapidly executed by no less than eighty of the foremost engineers of the country and their associates, this report, which embodies the first work undertaken by the Federated American Engineering Societies in rendering public service, reveals facts of incalculable value which may serve as a foundation for an advance in American industry. The report is divided into three parts: (1) giving a summary of detailed reports covering sources and causes of waste and recommendations for elimination of waste, (2) details of the engineers' field reports covering six major industries, of varied character and enormous annual output, and (3) general reports on specific industrial conditions such as unemployment, strikes and lockouts, accidents, health, etc. This report is the first instance of a collective or group endorsement of a general analysis of the sources and causes of waste and recommendations for its elimination. Its benefits will undoubtedly be far reaching as it points the way for locating and eliminating waste in other industries.

The thirtieth annual edition (1922) of Hendrick's Commercial Register, published by S. E. Hendricks Company, Inc., 70 Fifth Avenue, New York, contains 2,300 pages and comprises a thoroughly indexed and carefully classified register of producers, manufacturers, dealers and consumers connected with the electrical, engineering, hardware, iron, mechanical, mill, mining, quarrying, chemical, railroad, steel, architectural, contracting and kindred industries. The products are listed from the raw material to the finished article with the concerns handling them from the producer to the consumer.

Sternwheel Towboat for Mississippi River Service

(*Continued from page* 371)

capacities ranging from 5,000 to 9,000 barrels, a maximum distance of 150 miles. The oil will be discharged by means of pumping equipment located on the barges. Steam will be furnished from the boilers on the towboat at places where it cannot be obtained from shore. To provide for this, four 1½-inch steam connections have been provided on each side of the boat, two at the forward end of the main deck house and two at the after end of the boilers. When engaged in pumping it is proposed to operate a single battery of boilers.

The cabin, hurricane deck and pilot house are of wooden construction. Panels of 5/16-inch material attached to a light framework are used for the siding and partitions of the cabin to obtain a construction of light weight. A skylight the full length of the cabin provides for the proper ventilation of the quarters.

The hull and machinery plans for this boat were required to meet the approval of the American Bureau of Shipping for river service.

The Economic Efficiency of Merchant Ships

(*Continued from page* 390)

$$(f' C' - x T - q' F)]$$

where

$$F = k\, l\, \triangle^{2/3} V^2 L = \text{total fuel}$$

and the condition that E is a maximum is $\frac{\partial E}{\partial V} = 0$.

$$\therefore [(n_L V + L)(f' C' - x T - 3 q' F) - n_L V (f' C' - x T - q' F)] = 0$$

$$\therefore f' C' L - x T L - 3 q' F L - 2 q' F n_L V = 0$$

Whence

$$\frac{q' F V}{L}\left(\frac{3 L}{V} + 2 n_L\right) = f' C' - x T$$

And substituting

$$F = k\, l\, \triangle^{2/3} V^2 L$$

$$q' k\, l\, \triangle^{2/3} V^3 \left(\frac{3 L}{V} + 2 n_L\right) = f' C' - x T$$

the value of V which satisfies this equation will thus be the best speed V_B.

4. Condition for constant "best" speed when f and q vary

$$\frac{\partial V_B}{\partial f}\,\delta f' + \frac{\partial V_B}{\partial q}\,\delta q = 0$$

where

$$\frac{\partial V_B}{\partial f'} = \frac{1}{q'}\,\frac{C' q + r x T}{(q' k\, l\, \triangle^{2/3})(L + n_L V_B)\, 6 V_B}$$

$$\frac{\partial V_B}{\partial q} = -\frac{1}{q'}\,\frac{f' C' - x T}{(q' k\, l\, \triangle^{2/3})(L + n_L V_B)\, 6 V_B}$$

and substituting

$$\frac{\delta f'}{\delta q} = \frac{f' C' - x T}{q C' + r x T}$$

The equation is linear, and the effect of tonnage is to reduce the slope of the curve somewhat.

PERSONALS

A. R. Hunt, general manager of the Seattle plant of the Todd Shipyards Corporation, has been made vice-president.

J. E. Murphy, former traffic manager of the Emergency Fleet Corporation, has been appointed head of the division of passengers and mails of the Shipping Board.

Harry W. Kent, hitherto vice-president of the Todd Dry Docks Company of Seattle, has been made president of both the Seattle and Tacoma plants, succeeding C. W. Wiley.

William M. Truss, formerly with the Bethlehem Shipbuilding Coorporation, has been appointed marine sales manager of the Pusey and Jones Company, Wilmington, Del.

Alfred Buchi, chief engineer of Sulzer Bros., the Swiss manufacturers of the Busch-Sulzer Diesel engine, is at present in New York and will visit several other cities in the United States to study our methods of Diesel engine construction before returning to Switzerland.

Joseph T. Sheedy, European manager for the Emergency Fleet Corporation at London, has been made acting director of physical operations, with headquarters at Washington, D. C.

J. E. Andrews, who has been assistant to W. B. Keene, traffic manager of the Shipping Board, has been appointed head of the European division at Washington, succeeding F. G. Frieser.

David V. Stratton, well known in shipping circles and formerly holding an important position with the United States Shipping Board, has succeeded Lloyd Adam Noble with the Morse company.

Roy Parris has been appointed resident inspector on the 285-foot car ferry now building for the Missouri and Illinois Railroad at the plant of the Charles Ward Engineering Company, Charleston, W. Va.

Huntington T. Morse, former assistant to Joseph T. Sheedy, European manager of the Emergency Fleet Corporation, will succeed Mr. Sheedy in this capacity, still retaining the main office in London.

Harry Brown has tendered his resignation as a director and as technical manager of the Bethlehem Shipbuilding Corporation, Ltd., effective June 1. On this date Mr. Brown leaves for an extended vacation.

Lloyd Adam Noble, formerly manager of the New York office of Morse Dry Dock and Repair Company, has resigned his position and is now connected with the firm of W. and A. Fletcher Company, Hoboken, N. J.

C. W. Wiley, former president of the Todd Shipyards Corporation plants at Seattle and Tacoma, Wash., has been made chairman of the Board of Directors and personal representative of William H. Todd on the Pacific coast.

Allen Prangnell, who has been in the chartering department of S. O. Stray and Company of New York, will succeed W. L. Bull as head of the Mediterranean division of the United States Shipping Board at Washington.

V. J. Freeze, manager of the traffic department of the United States Shipping Board at Baltimore, will succeed Allan McLane, Jr., as head of the Far East and long voyage trade division of the traffic department at Washington.

W. L. Bull, in charge of the Mediterranean division of the Shipping Board at Washington, D. C., will be transferred to New York to succeed George H. Wells, who recently resigned as head of the European section of the New York office.

F. G. Frieser, in charge of the European division of the Washington offices of the Emergency Fleet Corporation, has been appointed special assistant to W. B. Keene, traffic manager and will have under his supervision homeward rates and traffic.

Louis F. Klein of New York has been appointed manager of the inland offices division of the Emergency Fleet Corporation traffic department. Mr. Klein has for many years been connected with railroad traffic work and has in addition made a thorough study of steamship operation.

Allan McLane, Jr., who has been head of the Far East and long voyage trade division of the traffic department of the United States Shipping Board Emergency Fleet Corporation in Washington, will shortly leave for England, where he will be connected with Runciman, Ltd., London, agents for the United States Lines.

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

More Than Sixty-Two Vessels Are in Course of Development as Part of New Construction Program for 1922

Shipbuilding Outlook for This Year Gives Renewed Cause for Optimism—Inquiries Becoming More Numerous and New Contracts Being Signed

THE construction of over sixty-two vessels as a part of 1922's shipbuilding program, which has been forecasted frequently by MARINE ENGINEERING AND SHIPPING AGE, seems nearer at present than at any time so far during the year. While there are a few ships already contracted for and under construction at the present time there is a steadily increasing number being brought out as "in contemplation" and while it is possible that all of the new ships under consideration will not reach the actual construction stage, there is every reason to believe the majority of the vessels now being planned tentatively will sooner or later be built. As concrete evidence that American shipbuilding is recovering rapidly from the recent depression, a total of sixty-two vessels are listed below of which seven have been definitely contracted for or are already under construction.

The Department of Plant and Structures of the City of New York has awarded a contract for the construction of three turbo-electric ferries to the Staten Island Shipbuilding Company to be built at a total cost of $1,589,900. The same department is working on plans and specifications for seven Diesel electric ferries for the East River routes.

The signing of contracts for seventeen electric drive freighters, designed by Theodore D. Wells, naval architect of New York, for ocean and river service for the Central Steamship and Commerce Corporation and also for five Diesel electric cargo boats of special design by R. R. Livingston, naval architect of New York, for the Canal and River Transportation Company, is considered more imminent now than at any time since the work was proposed.

Taken in conjunction with the proposed construction of 10 ships for the New England Oil Refining Company; six for the North Atlantic and Western Steamship Company (Nawsco Line), which is said to be considering motorships; two steamers for the Eastern Steamship Company, plans and specifications for which are now nearing completion; two for the Old Dominion Steamship Company; two for the Red "D" Line; two for the Cleveland and Buffalo Transportation Company; one for the Catskill Evening Line; one for the Savannah Line; two recently contracted for with the Federal Shipbuilding Company by the Merchants' and Miners' Transportation Company; two being built by the Pusey & Jones yard for the Seaboard-Bay Line, the shipbuilding and equipment prospects appear in a brighter light than has been evident in many months.

Contract Is Placed for New 600-Foot Great Lakes Steamship

THE American Shipbuilding Company, of Cleveland, Ohio, has been awarded a contract by the Franklin Steamship Company of Cleveland for the construction of a new steamer at a cost said to be close to $800,000.

The new steamer will be 600 feet in length, 64 feet beam by 33 feet deep and will be equipped with three Scotch boilers, 14 feet diameter by 11 feet long and a triple expansion engine with cylinders 25½ by 41 by 67 with 42 inch stroke. The vessel is for use on the Great Lakes.

New Ferryboat to Be Built by Staten Island Yard

The Staten Island Shipbuilding Company of Staten Island, New York, has been awarded a contract for the construction of a ferryboat for the Erie Railroad.

It is understood that the new vessel will be a duplicate of the ferryboat *Jamestown*, operated by the same company, which is 206 feet long, 44 feet beam, driven by a two-cylinder compound engine, 18 by 38 by 28, developing 1,200 indicated horsepower, steam being supplied by two single-ended Scotch boilers having a working pressure of 150 pounds of steam. The *Jamestown* was built by the same shipyard in 1907.

Two Steel Quarter Boat Hulls to Be Built for Nashville

Sealed proposals will be received by U. S. Engineer Office, Nashville, Tenn., until 11 A. M., June 26, 1922, for constructing two steel quarter boat hulls. Further information on application.

Specifications For Converting Four Steel Ships Expected Soon

Admiral Line Vessels to Be Made Into Motorships, Costing Over Quarter Million

PROSPECTS for the issuance of specifications for the conversion of the steel auxiliaries *Dawnlite, Daylite, Starlite* and *Moonlite* into motorships, which it is understood will involve the expenditure of a total of close to $300,000 or over, for the Admiral Line, have improved materially, according to information obtained by MARINE ENGINEERING AND SHIPPING AGE.

The boats are of about 3,000 deadweight tons each and while definite plans have not yet been made it is understood that three of the barges may be equipped with Diesel engines and electric auxiliaries and one equipped with Diesel engines and steam auxiliaries. It is also reported that the auxiliaries are to be taken from certain wooden ships acquired by the Admiral Line on the Pacific Coast.

Indications are that the Admiral Line will request bids for the conversion work from shipyards on both the Atlantic and Pacific coasts.

Bids May Be Asked in Near Future for Fleet of New Special Type Tankers Costing Millions

Foreign as Well as American Shipyards Will Submit Figures on Vessels Proposed by New England Oil Refining Company for South American Service

BIDS are expected to be asked in the near future for the construction of a number of self-propelled oil carriers possibly from 10 to 15 for the New England Oil Refining Company of 25 Broadway, New York City, which is understood to be contemplating the construction of such boats for service on Maracaibo Lake, South America. If such a program is carried out, from three to six million dollars may be expended in the construction of a special type steel ship. It is also understood that the company will obtain bids from foreign shipbuilders as well as from yards in America.

Details concerning the preparation of final plans and specifications were not available at present, although it is considered likely that the ships will be close to 300 feet in length with the strong possibility that the propelling machinery would consist of triple expansion steam engines with steam supplied by two Scotch boilers. In order to meet requirements, the vessels will probably have a draft of 10 or 11 feet in order to make the passage to and from Maracaibo Lake.

Plans Being Pushed for Seven Diesel-Electric Ferries to Be Built For East River Service, New York

Final Specifications Will Provide for Steel Boat 175 Feet Long, Driven by Two 400-Horsepower Diesel Engines—Hope to Ask for Bids Before Summer

PLANS and specifications for the construction of a total of seven Diesel electric ferryboats by the Department of Plant and Structures of the City of New York, for service in the East River, are well under way, according to an announcement by Commissioner Grover A. Whalen. The bids for these vessels will probably be received within a few weeks and it is estimated that the boats will cost a total of approximately $1,540,000.

With regard to the construction and equipment of these ferries, Commissioner Whalen said:

"We have designed a boat 175 feet long over all with a breadth of 64 feet, having ascertained by actual experience that this is the best size for handling in congested waters of the East River with its peculiar currents and eddies.

Construction

"We propose to build the boats of steel, with five watertight compartments in the hull, with three vehicle gangways and cabins for passengers on the overhang on each side. By abandoning the old steam engine type and using screw propellers instead of side wheels we can have the room for the third runway.

Propulsion

"We are considering installing in each boat two 400-horsepower engines of the Diesel type. Specifications are being prepared that permit of the widest possible competition, under which engines of the solid fuel injection type or of the high pressure air atomized type may be used.

"There are several makes of engines of each of these types that have demonstrated their dependability, such as Ingersoll-Rand, Worthington and De LaVergne of the former type, and the Werkspoor, Winton, New London, McIntosh & Seymour and Busch-Sulzer of the latter type.

"A generator will be direct connected to each engine producing the electric current to propel the boat at a speed of 12 miles an hour and to operate the auxiliary machinery.

Control.

"It is designed to install three master controllers, one in each pilot house and one in the engine room, so that the pilot can control the starting, stopping and reversing and regulate the speed, or the control can be taken over by the engineer and operated in response to usual ship telegraph and bell signals.

"It is planned to provide service gravity tanks to feed the fuel oil to the engines and storage tanks that will carry ten days' supply. The same fuel will be used for the small steam boiler that will provide heat in winter.

"The preliminary studies have been under way for six months and we are now at work on the actual plans and specifications, hoping to advertise contracts for seven ferryboats of this type before summer."

Fireboat Planned For New Orleans, La., Is To Be Oil Burner

Will Be Driven by Reciprocating Engines and Is to Have Complete Fire Fighting Equipment—Bids June 29

THE Board of Commissioners of the Port of New Orleans are advertising for bids on the construction and delivery of a steel screw fireboat 138 feet 6 inches long, 29 feet beam and 15 feet (inches deep. She will be fitted with compound engines 20½ inches and 46 inch diameters of cylinders and 28-inch stroke.

There will be four turbine driven fire pumps, of a combined capacity of 10,000 gallons per minute at a pressure of 200 pounds per square inch at the pumps. Four 6-inch monitor nozzles will be installed, one on a high tower aft of the main engine hatch, two on platforms amidships, and one on the pilot house. Sixteen hose connections will be provided on the turrets under the midship monitors, and swivel nozzles are fitted on the main rail at intervals. Three steel hose reels on deck will carry about 2,500 feet of hose. There is to be a complete outfit of all modern appliances for fire fighting.

There will be two watertube boilers for 225 pounds working pressure, fitted to burn fuel oil. All auxiliaries are independent. The vessel will be built for classification, but far in excess of all rules. When in action, she will deliver over fifty tons of water per minute. She was designed by and will be built under the supervision of Cornell and Matthews, naval architects and engineers, Philadelphia. Bids will be opened in New Orleans, June 29, 1922, and it is believed the vessel will cost close to $250,000.

Robins Yard of Todd Corporation Low Bidder for Huron Reconditioning

The Robins Dry Dock & Repair Company of the Todd Shipyards Corporation, with a price of $179,000, submitted the lowest tender for reconditioning the steamship *Huron* at the opening of bids by the Shipping Board at 45 Broadway, New York City, on May 12. The prices submitted were as follows:

Robins Dry Dock & Repair Co....	$179,000
Bethlehem Shipbuilding Corp.	183,162
Morse Dry Dock & Repair Co.....	190,900
Sun Shipbuilding Co.	258,578

Fuel Oil Burning Equipment for Army Dredge

Fuel oil burning equipment has been ordered for installation on a United States Army dredge located at Porto Rico. The equipment selected is the Bethlehem (Dahl) mechanical system built by the Bethlehem Shipbuilding Corporation, Ltd., and the installation is being made at Porto Rico. The order was placed through the office of the Second District, United States Army Engineers, New York.

Buxton Line Will Replace Vessels Lost In Fire and Crash

THE Buxton Steamship Company of Norfolk, Va., on April 13, lost in a fire at Berkly the 115-foot oil burning ocean tug *Buxton*, the 216-foot side wheel excursion passenger steamer *Rosedale*, the 135-foot freight steamer *Martha Stevens* and the 71-foot auxiliary twin-screw passenger boat *Watch Hill*.

On April 21 their 176-foot oil burning freight steamer *Brewster* was rammed and sunk by the New York-Richmond Line steamer *Lake Stirling* while en route from Richmond to Norfolk with cargo. Chief Engineer, C. W. Hussey was lost with the *Brewster*. This steamer had recently been overhauled, having new boilers and other new equipment installed.

Disregarding all of these losses, the Buxton Line is reported to be going right ahead, having faith in the future of Norfolk as a port city. It is stated that the company intends to replace all of these ships at some future date but is in the market for a ship to replace the *Brewster* at once, as this boat is needed on the Norfolk-Richmond run.

Standard Oil May Convert Steam Tankers to Motorships

According to latest reports, the Standard Oil Company of New Jersey is planning the conversion of several of its tankers from steamships into motorships. It is understood that propulsion equipment developing close to 3,000 horsepower, driving twin screws, may be installed in each ship converted. Further details as to the number of ships which may be involved, or the amount of money which may be expended, were not available at this time.

Newport News Yard Gets Tanker Libby Repairs

The contract for repairs to the Standard Oil tanker *W. H. Libby*, consisting chiefly of bottom damage effecting 35 plates, has been awarded to the Newport News Shipbuilding and Dry Dock Company. The bids submitted for the work were as follows:

Newport News Shipbuilding & Dry Dock Co.	$34,615
Robins Dry Dock & Repair Co......	37,700
Staten Island Shipbuilding Co.......	38,445
Morse Dry Dock and Repair Co....	43,882

Third Annual Dinner of the Marine Committee of the American Institute of Electrical Engineers at the Hotel Astor, New York, on April 28

Marine Committee of American Institute of Electrical Engineers Holds Third Annual Dinner

Set of Standardization Rules Prepared on Good Engineering Practice Covering Fire Protection and Marine Construction Requirements

THE third annual dinner of the Marine Committee of the American Institute of Electrical Engineers was held at the Hotel Astor on April 28, 1922. This committee was originally appointed by the American Institute of Electrical Engineers in 1913 because of the differences existing between the requirements of various classification societies and insurance companies in regard to electrical installations on shipboard and the lack of any accepted standard engineering practice for marine installations.

Besides arranging for papers to be read at the meetings of the Institute to increase the interest of electrical engineers in marine problems, the committee took up the preparation of standardized rules which would represent good engineering practice and which might be accepted by the classification societies. As a result, a set of rules was prepared covering two important divisions, namely: fire protection requirements and marine construction requirements. These rules were adopted by the committee of the American Bureau of Shipping and were published as Section 37 of the Rules for Building and Classing Vessels issued by that Bureau.

As the first edition of the rules did not cover the entire field of the use of electricity on shipboard, the Marine Committee was continued and a more nearly complete set of marine rules has now been issued which in the arrangement and scope conform to a similar set of regulations issued by the Institution of Electrical Engineers in England. The committee is now undertaking a work of far-reaching importance with a view to establishing approved standards in the application of electricity to merchant ships.

The members of the committee are as follows:

Arthur Parker, New York Shipbuilding Corporation, Camden, N. J., chairman; L. C. Brooks, Bethlehem Shipbuilding Corporation, Quincy, Mass., secretary; J. B. Bassett, General Electric Company, New York; R. A. Beekman, General Electric Company, Schenectady, N. Y.; Eskil Berg, General Electric Company, Schenectady, N. Y.; Maxwell W. Day, General Electric Company, Schenectady, N. Y.; David D. Faris, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; E. G. Gallagher, Lake Torpedo Boat Company, Bridgeport, Conn.; H. Franklin Harvey, Jr., Newport News Shipbuilding & Dry Dock Company, Newport News, Va.; William Hetherington, Jr., Cutler-Hammer Manufacturing Company, New York; H. L. Hibbard, Cutler-Hammer Manufacturing Company, New York; J. S. Isdale New York Harbor Dry Docks Corporation, New York; William F. James, Westinghouse Electric & Manufacturing Company, Philadelphia, Pa.; Commander C. A. Jones, U. S. N.; Commander C. S. McDowell, U. S. N.; W. F. Meschenmoser, Russell & Stoll Company, New York; T. H. Osborne, Federal Shipbuilding Company, Newark, N. J.; G. A. Pierce, Jr., William Cramp & Sons Ship and Engine Building Company, Philadelphia, Pa.; Commander S. M. Robinson, U. S. N.; H. M. Southgate, Westinghouse Electric & Manufacturing Company, Washington, D. C.; W. E. Thau, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; F. P. Townsend, Kindred Appliances Company, Newark, N. J.; A. E. Waller, Ward Leonard Electric Company, Mt. Vernon, N. Y. and F. W. Wood, Charles Cory & Sons, Inc., New York.

Atlantic Coast Shipbuilders' Association Holds Annual Convention

THE annual meeting of the Atlantic Coast Shipbuilders' Association was held in Philadelphia on Monday, May 8, 1922. Representatives of every shipbuilding district in the East attended the meeting and the list of speakers included W. Averill Harriman, chairman of the American Ship and Commerce Corporation; Honorable George Earle Chamberlain, Commissioner of the United States Shipping Board, and Admiral Louis McCoy Nolton, commandant of the Philadelphia Navy Yard, who spoke with considerable significance regarding a permanent future for shipbuilding as a successful American industry.

It was emphatically stated that America's future on the high seas depends for the most part on liner service and attention was called to the fact that this country is at present greatly lacking in vessels of this class and that every effort should be made to obtain ships that can compete successfully with countries that are our chief rivals in foreign trade.

The following officers were re-elected for the ensuing year: President J. L. Ackerson; vice-president, George H. Bates; treasurer, J. Harry Mull; secretary, Clarence Samuel King.

Federal Shipbuilding Company Low Bidder for Poznan Reconditioning

THE Federal Shipbuilding Company was low bidder for reconditioning the steamship *Poznan* of the Luckenbach Line at the opening of tenders at the Luckenbach pier, Brooklyn, on May 20. The prices submitted were as follows:

Federal Shipbuilding Co.	$207,000
Robins Dry Dock & Repair Co.	224,940
Sun Shipbuilding Co.	229,076
Tietjen & Lang	257,620
Bethlehem Shipbuilding Corp.	272,253
New York Harbor Dry Dock Co.	345,000
Newport News Shipbuilding & Dry Dock Co.	373,000
W. & A. Fletcher Co.	383,000

The work covered by the specifications included the reconditioning of the vessel for certificate of local inspectors of the Panama Canal, Suez Canal and the American Bureau of Shipping. The principal work is to open up all the main engines, overhaul them, remove the boilers, replace with new boilers furnished by the owners, recondition the rigging, recondition the fire fighting system, removing the gun foundations, relocating the king posts, installing a gyro-compass, renovating the cargo pipe system on deck, preparing the tanks for fuel oil including new separate tanks, installing the Peabody oil-burning system complete, reconditioning the wooden decks, overhauling all the communicating systems, reconditioning the fire and floor plates and installation of the Rand fuel oil heating system. The ship is to be renamed the *Frederick Luckenbach*.

Thatcher Propeller Company to Expand Plant

The Thatcher Propeller and Foundry Corporation, Albany, N. Y., is offering for public subscription approximately $250,000 of its new issue of 8 percent cumulative preferred stock and common stock. The object of this issue is to raise capital to permit the purchase of additional machinery, electric travelling cranes, a manganese bronze furnace, the latest type of steel furnace and also raw materials.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Fireboat, New Orleans, La.—Board of Commissioners of Port of New Orleans will open bids June 29 for the construction and delivery of steel screw fireboat, 138 feet 6 inches long, 29 feet beam and 15 feet 6 inches deep. To be fitted with compound engines 20½ inches and 46 inch diameter of cylinders and 28-inch stroke.

Steamship to Be Fitted for Refrigeration.—Plans and specifications for conversion of steamship San Lorenzo, of New York and Porto Rico Line, to carry citrus fruits from West Indies, expected to be completed soon. Work will probably cost close to $100,000.

Repair Contract, Staten Island, N. Y.—Staten Island Shipbuilding Company awarded contract for hull work on pilot boat New York, at opening of bids by United New York-Sandy Hook Pilots' Benevolent Association, Whitehall St., New York, on May 11.

Overhauling of Tanker, New York.—New York Harbor Dry Dock Company awarded contract for general overhauling of hull and machinery of tanker H. C. Bedford, of Standard Oil Company of New Jersey, at opening of bids on May 10. Price $8,021.

Miscellaneous Repairs, Chester, Pa.—W. M. Irish, tanker of Atlantic Refining Company, was drydocked for miscellaneous repairs at Sun yards.

Reconditioning of Steamer, Oakland, Cal.—Repairs amounting to $44,900 made to Pacific Mail liner, Wolverine State, by Moore yards, Oakland, Cal., including installation of steerage accommodations for 219 passengers and changing of the engineers' quarters. Vessel will engage in passenger and freight-carrying trade from San Francisco to Manila and Hong-Kong via Honolulu with her sister ship, the Creole State.

Danish Steamer Repaired, Newport News, Va.—All necessary repairs to Danish ship Anna Meersk made by Newport News Shipbuilding and Dry Dock Company.

Repairs to Brazilian Steamship, Newport News, Va.—Large Brazilian steamer Camamu was repaired at Newport News shipyard. Raleigh-Smokeless Fuel Company, agents for vessel.

Steamer Dry Docked, Galveston, Texas.—The Mundelta drydocked at Galveston, Texas, and underwent repairs caused by damages sustained recently at Sabine when rammed by Shipping Board tanker Mevania.

Steamship at Naval Plant, Seattle, Wash.—The Wenatchee, Shipping Board's big transpacific liner, at Bremerton Navy Yard, Seattle, Wash., for drydocking, inspection and overhauling.

Schooner Repairs, Boothbay, Me.—Schooner Margaret Thomas, undergoing extensive repairs at Boothbay Harbor, which will take several weeks to complete.

New Ship Propeller.—The Grace Liner Colusa shifted to San Francisco, Cal., for drydocking and inspection and installed a new propeller.

Steamer Burns, Havana, Ill.—The 2,500-ton Mississippi River steamer Majestic burned at Havana, Ill. Steamer left Peoria for Havana a few days previous to its destruction.

Dredge Dry Docked, Oregon.—Government dredge Colonel P. S. Michie drydocked for repairs to her propeller and upon completion returned to her station at Coos Bay.

Norwegian Steamship Dry Docked, Philadelphia, Pa.—First vessel consigned to B. H. Sobelman & Company for new Baltic service from Philadelphia, Norwegian steamship Rio Grande, drydocked at Cramp's shipyard, Philadelphia, for bottom painting, before going into berth at Pier C, Richmond.

Miscellaneous Repairs, Chester, Pa.—J. C. Donnell, tanker of Atlantic Refining Company, drydocked at Sun Shipyard for miscellaneous repairs.

General Overhauling of Tug.—The boarding tug Governor Pennypacker, used by the health officers at Marcus Hook, was overhauled at Philadelphia.

Eleven Ship Repair Contracts, Hoboken, N. J.—Over eleven repair contracts were awarded to the W. & A. Fletcher Company, Hoboken, New Jersey, during the week ending May 13. Work provided for both hull and engine repairs and reached a total in excess of $42,000.

Tug on Marine Railway, Philadelphia, Pa.—Tug Henry P. Mills, of Delaware River Towing Company, recently went to Marine Railway at Philadelphia Ship Repair Company's yards. Her machinery was disabled.

Dredge Repaired, Portland, Ore.—The Colonel P. S. Michie went to Portland, Ore., for repairs.

Extensive Steamer Repairs, Brooklyn, N. Y.—Contract for reconditioning steamship Princess Matoika awarded Morse Dry Dock & Repair Company, Brooklyn, N. Y.

Specifications for Conversion.—Issuance of specifications for conversion of steel auxiliaries Dawnlite, Daylite, Starlite and Moonlite into motorships, understood to involve a total of close to $300,000 or over, for Admiral Line, expected soon.

Bids for Tankers, N. Y.—Bids are expected to be asked in near future for construction of a number of self-propelled oil carriers, possibly from 10 to 15, for New England Oil Refining Company, of 25 Broadway, New York City, understood to be contemplated for service on Maracaibo Lake, South America. If such a program is carried out, from three to six million dollars may be expended.

Boat Hulls, Nashville, Tenn.—Sealed proposals will be received by U. S. Engineer Office, Nashville, Tenn., until 11 A. M., June 26, 1922, for constructing two steel quarter boat hulls. Further information on application.

Contract for Steamship, Cleveland, O.—American Shipbuilding Company, Cleveland, Ohio, awarded contract by Franklin Steamship Company, Cleveland, for construction of new steamer at cost said to be close to $800,000. New steamer to be 600 feet long, 64 feet beam by 33 feet deep, and equipped with three Scotch boilers, 14 feet diameter by 11 feet long and a triple expansion engine with cylinders 25½ by 41 by 67 with 42 inch stroke. Vessel for use on Great Lakes.

Ship at Southern Yard.—British steamship Balsa went to Southern Shipyard, having been bought and floated by Captain Griffin, of Norfolk, after being stranded.

Ships at Colonna Shipyards, Norfolk, Va.—Ships in Colonna yard recently were: Barkentines State of Bumont, State of New Orleans and Mercerata, for general repairs to hull and auxiliary machinery; United States Shipping Board steamer American Press, for painting, scraping and bottom repairs; Shipping Board steamer Tenafly, for survey and general repairs; steamship Mazama, repairs to machinery; tug Eastern, general repairs; and fishing steamers Rappahanock, Peconie, E. W. Edwards, M. M. Davis, East Hampton, Dolphin, Northumberland, B. H. B. Hubbard, A. Brooke Taylor, G. S. Allen, D. K. Phillips and the Steven W. McKeever, all for seasonal overhauling. Yard repaired a number of car floats for N. Y. P. & N. Railroad.

Tanker for Repairs, Brooklyn, N. Y.—Contract for repairs to Standard Oil tanker H. M. Flagler awarded to Robins Dry Dock & Repair Company of Todd Shipyards Corporation at $12,495.

Contract Awarded, Newport News, Va.—Contract for repairs to Standard Oil tanker W. H. Libby, consisting chiefly of bottom damage effecting 35 plates, awarded to Newport News Shipbuilding and Dry Dock Company at $34,615.

Steamship Overhauled, San Francisco, Cal.—The Valdez, out of commission all winter, shifted to Heffernan Dry Dock, San Francisco, Cal., for overhauling preparatory to being placed in commission.

Low Bidder for Reconditioning, Brooklyn, N. Y.—Robins Dry Dock & Repair Company of Todd Shipyards Corporation, with price of $179,000, submitted lowest tender for reconditioning steamship Huron at opening of bids by Shipping Board at 45 Broadway, New York City.

Construction of Scows, New York.—Plans and specifications issued and bids will be received by Board of Purchase of City of New York in Room 526, Municipal Building, Borough of Manhattan, from 9 to 10:30 A. M., Monday, June 5, for furnishing to Street Cleaning Department twelve side-dumping scows at cost estimated at close to $250,000.

Contract for Three Ferries, Staten Island, N. Y.—Contract for three steel screw electric-driven ferryboats awarded by Commissioner Grover A. Whalen, of the Department of Plant and Structures, New York, to Staten Island Shipbuilding Company at total cost of $1,589,900.

Five Cargo Boats.—A contract for construction of five Diesel electric cargo boats for Canal & River Transportation Company, New York, and which it is understood will involve expenditure of over $500,000, expected to be placed in near future.

Conversion to Motorships.—Standard Oil Company of New Jersey planning conversion of several of its tankers from steamships into motorships. It is understood that propulsion equipment developing close to 3,000 horsepower, driving twin screws, may be installed in each ship converted.

Steamer Refitted, Seattle, Wash.—Steamship Brookdale, after lying idle in Lake Union a year, has been repaired and refitted for cannery trade at Eagle Harbor plant of the Winslow Marine Railway & Ship Repairing Company, Seattle, Washington. She is one of the largest wooden carriers built for the Shipping Board, being 272 feet long, 49 feet beam, and of 4,200 deadweight tons.

Wooden Steamer Repaired, New Orleans, La.—American steamer Nika, one of wooden vessels built at Moss Point, Mississippi, by Hodge Shipbuilding Company, during the war and completed the latter part of 1919, repaired at Henderson Dry Docks. She was recently bought by F. M. Starks of San Francisco, and entered service at Mobile, taking cargo to Pacific Coast.

Repairs to Steamer, Newport News, Va.—British steamer Madras City repaired at Newport News Shipbuilding & Dry Dock Company's yard.

Renewed Activity, Gloucester, Mass.—Cape Ann Anchor Company, of Gloucester, Mass., has started plant on one-third normal capacity basis after idleness of over five months. A. P. Stoddart & Company, engineers and machinists of Gloucester, Mass., report increasing number of inquiries, also larger volume of business. This plant is making hoisting winches and steering gear for small and medium-sized vessels and are equipped to handle fair-sized marine engine and motor work.

Miscellaneous Repairs, Chester, Pa.—Steamship Ontario, of Merchants & Miners' Transportation Company, drydocked at Sun Shipyard for miscellaneous repairs.

Contracts Awarded, Brooklyn, N. Y.—Two contracts, probably involving total expenditure of close to $175,000, awarded Robins Plant of Todd Shipyards Corporation, Brooklyn, New York. The contracts included reconditioning of the steamships Mexico and City of Savannah.

Construction Contracts, Pittsburgh, Pa.—Dravo Contracting Company, Pittsburgh, Pa., awarded contract by United States District Engineer, Army Building, New York, for construction of steel oil barge for service in New York waters and water barge for service at Philadelphia, with bid of $41,200.

PORT IMPROVEMENTS

Contract Awarded, Seattle, Wash.—Colby Steel & Engineering Company, 416 Central Building, Seattle, Wash., awarded contract by Port of Grays Harbor Commissioner, 206 East Wiskah street, for one 5-ton crane, 95-foot hammerhead crane.

Pier, Cape May, N. J.—W. C. Hunt, 1220 Vine street, Philadelphia, building timber pile pier at Cape May, N. J. Price, $60,000 (timber theatre included). A. J. Sauer, Dencla Building, Philadelphia, engineer.

Dredging Contract, New York.—A contract has been signed between the Mexican Government and American Dredging Company of New York, for deepening and otherwise improving the port of Frontera, in the State of Tabasco, one of the wealthiest ports of the Republic of Mexico.

Grain Elevator, Norfolk, Va.—The contract for construction of Norfolk's new municipal grain elevator awarded to A. M. Crain & Company, of Chicago, whose bid of $639,900 was lowest of six offers, when the time of completion is taken into consideration.

Plans to Deepen Harbor, Gulfport, Miss.—Major Earl North, government engineer in charge of Gulfport, Miss., district, port commissioners of the city of Gulfport, City Attorney Heiss and Mayor Haldon of Gulfport, held important conference recently relative to contemplated improvements of Gulfport harbor and channel. Funds available for dredging this year amount to $175,000, sufficient to dredge channel to 23 feet at mean low tide, making it possible for vessels to go out drawing twenty-five feet. Dredge Pascagoula has commenced work and will be used to deepen channel to municipal pier to make it available to vessels drawing twenty feet. Deepening water for Gulfport, it is believed, will increase shipping.

Piers and Docks, Cleveland, O.—Detroit & Cleveland Navigation Company, foot of East 9th street, Cleveland, O., plans one-story concrete piers and docks, 300 by 700 feet, at $400,000. D. C. McIntyre, manager. Private plans.

Terminal Construction, Memphis, Tenn.—City of Memphis, Tenn., Rowlett Payne, mayor, and Federal Government to construct $500,000 terminals; let contract to R. W. E. Thompson, Earle, Ark., to build 4 concrete floating docks equipped with steel sheds and electric cranes, 1,600 feet tramway extending into the river parallel with the bank. Storage yards and sheds provide facilities for loading and unloading of freight, etc.

Dredging Contract Award, New York.—Port Commissioner of Norfolk, Va., let contract to Atlantic Gulf & Pacific Company, Park Row Building, New York City, for dredging and filling 750,000 cubic yards at Sewells Point, in connection with proposed city terminals.

Contract for Harbor Work, St. Petersburg, Fla.—City let contract to St. Petersburg Concrete Construction Co., 1141 1st street, to construct concrete slab sea wall and dock, part of Bayboro harbor improvements, costing $50,000. E. C. Tarrin, City Engineer.

Harbor Improvements, Miami, Fla.—Bowers Southern Dredging Company, Galveston, Texas, awarded contract by city commissioners to dredge turning basin and slip between docks, $99,060.

Dam, Poplar Bluff, Ark.—Butler County Commissioners contemplating building flood detention dam; approximate cost, $8,000,000.

Dock System, Ohio River.—The Inland Waterways Company formed to build extensive system of docks on Ohio River at Louisville, Kentucky, and Jeffersonville, Indiana. Work opens vast possibilities and is to be started this summer. Interstate Public Service Company to construct the docking system on Indiana side of river and will have charge of operations there.

Development of Oakland Harbor, Cal.—U. S. War Department approved plans for development of Oakland, California, on eastern shore of San Francisco Bay. Estimated expenditure, $1,371,405, part of cost to be borne by City of Oakland and part by Federal Government.

NEW INCORPORATIONS

Los Vecinos Company, Ltd., capital $5,000,000, to operate passenger and freight ships between Los Angeles and Mexican and Central American ports, incorporated in California as a common law trust. President and general manager, John C. Allen; vice-president and assistant general manager, Joseph McMillan; vice-president and secretary-treasurer, E. W. Eidney.

The Western Transportation Company, Wilmington, Delaware, capital $100,000, incorporated at Dover, Delaware, to do business in steamships; Corporation Trust Company of America, at Wilmington, registrars.

The Pennsylvania Shipyards, Wilmington, Delaware, capital $300,000, incorporated at Dover, Delaware.

Delta Export Lumber Corporation, capital $500,000, incorporated at Dover, Delaware, to do an export and import lumber business; incorporators, R. L. Jurden, James E. Stark, and R. G. Hackney, of Memphis, Tenn.

Allen-Jonsen Company, Tampa, Florida, organized by Randolph P. Allen, Carston A. Jonsen and Axsel Pederson; reported to have taken over complete equipment of Daniels Shipyards; plan to build either wood or steel ships of any tonnage.

Union Marine Service Corporation, Fairfield, Maryland, capital $30,000, chartered by Rupert C. Cowles, Charles Hoffman and Frank J. Whelan; to repair ships.

Maryland Dry Dock Company, Fairfield, Maryland, capital $2,000,000, incorporated with John A. Spillman, president; George E. Probst, secretary-treasurer; successors to Globe Shipbuilding & Dry Dock Company; to build ships.

Marine Dispatch Steamship Line, Title Building, Baltimore, Maryland, capital $10,000. Frank B. Ober, Joel W. Massie and Charles B. Hoffman; incorporators.

Dunn-O'Neill Transportation Company, Inc., Clarendon, Va.; Robert O'Neill, president; Harold E. Dunn, secretary.

Kenova Wharf & Ferry Company, Kenova, West Virginia. Organized to establish steam ferry between Kenova, West Virginia, and North Kenova, Ohio.

Inland Waterways Company, Indianapolis, Indiana, build extensive system of docks on the Ohio River at Louisville, Ky., and Jeffersonville, Ind.

Wilbur F. Spice & Co., steamship lines, 300 Chamber of Commerce Building, Baltimore, Maryland, capital $50,000; Robert C. Herd, Henry R. Guttner and Hester R. Spice; incorporators.

"Chilian Lloyd," Valparaiso, Chile, capital $2,000,000, reported to have been founded for the purpose of providing a regular connection with the principal ports of the West Coast. Most of the capital, it is stated, has been subscribed by an important group of merchants who will ship their goods by the new line. The service will be carried on by two 1,800-ton steamers at the outset, which, besides cargo, will be able to carry a small number of passengers.

Argonaut Steamship Company, New York, incorporated under laws of the State of New York, capital $250,000. A. H. Ely, E. P. Collins and H. P. Elliott are reported as incorporators.

FOREIGN ACTIVITIES

Proposed Ports for China.—Negotiations being carried with view to opening Whampoa, China, as commercial port, and plans prepared for harbor capable of accommodating ocean-going vessels. A company has been promoted for purpose of developing Tsingingchow, with a capital of $3,000,000. The company applied to Government for additional $200,000 necessary to finance the undertaking.

New Port of Call, Germany.—The Kroonland, Red Star liner, is to call at Cuxhaven to land passengers. This is first occasion for old Antwerp service to run into this German port.

New Dry Dock, South Wales, England.—Work in connection with construction of new drydock at Swansea by Sir John Jackson, Limited, for Palmers (Swansea) Dry Dock Company is progressing. The Mayor of Swansea made an appeal to Sir John Jackson to give as much work as possible to local men, stating that in anticipation of work non-residents were pouring into the district from all over the country.

Tanker Launched, Belfast.—Messrs. Workman, Clark and Company launched at Belfast the steamer British Engineer, 440 feet long, 6,990 tons, for British Tanker Company's Anglo-Persian oil service. There are ten holds for carriage of oil cargoes, with additional capacity for light oils in tanks built in the 'tween decks.

Port Developments, Argentine.—Report favorable to project of reconstructing wharves and dock at Port of La Plata, Argentina, to accommodate ships drawing up to 30 feet has been made by Communications and Transport Committee of Chamber of Deputies. The scheme is estimated to involve expenditure of over $4,000,000, of which half is included in budget for 1921 and half in that of 1922. New port works at Buenos Aires, being carried out by Messrs. C. H. Walker & Company, under revised contract necessitated by the war, are proceeding satisfactorily. An expenditure of $5,000,000 has been recommended for provision of warehouses and other storage accommodation equipped with electric cranes and cargo handling appliances. Dredging operations are being actively pursued in order to facilitate access to new port, which will receive vessels drawing up to 33 feet.

New Italian Motorships.—Two motorships, one an oil tanker, are being built by Ansaldo San Giorgio for the Roma Steamship Company. Tanker to be of about 8,500 tons deadweight, driven by two Ansaldo two-cycle Diesel engines of 1,100 brake horsepower each, giving speed of 10½ knots on fuel consumption of about 11 tons daily. Steam to be utilized for driving cargo pumps and other auxiliary machinery, although compressed air will be employed for operating steering gear and minor engine-room auxiliaries when the vessel is at sea. The other ship, to be named Faleria, will be of 8,100 tons deadweight, 377 by 51.9 by 24.6 feet draft. Propelling machinery to be similar to that in the ship previously mentioned, and a speed of about 10½ knots is anticipated on an equivalent fuel consumption.

Shipbuilding at Amble, Northumberland Coast.—The Amble Shipbuilding Company, subsidiary of Palmers Iron and Steel Shipbuilding Company, Ltd., Jarrow, has secured an order for building 28 double decked motor boats for service on the Thames. Boats are to order of Thames Motor Boat Passenger Services, Ltd., new company being formed to develop passenger traffic on Thames between Woolwich and probably work higher reaches of the river. They will average 100 feet long, 16 feet beam, and carry 200 passengers each. To be of twin screw type, with Thornycroft engines.

Pittsburgh's Maiden Trip, England.—The new White Star Liner Pittsburgh, 16,600 tons, is due to commence her maiden trip in the company's service from Liverpool and Queenstown to Boston and Philadelphia on June 6. The Pittsburgh is a two-class boat of the Regina type. The ship is equipped with all modern conveniences and luxuries, and her machinery, which is of most up-to-date character, will include six double-ended multitubular cylindrical boilers, total weight being over 650 tons. There are 36 furnaces and 4,764 smoke tubes. The Pittsburgh will work in conjunction with the popular Haverford, a twin screw vessel of 11,635 tons gross register.

Bordeaux and St. Nazaire Improvements, France.—Port authorities at Bordeaux and St. Nazaire planning extensive installation schemes. With approval of Midi and Orleans railways, which are interested, a bill will shortly be tabled in the Chamber to authorize construction of an outer port, to be termed the Port de Verdon, at Bordeaux. St. Nazaire authorities have decided to deepen harbor throughout, building in lower roadstead a new 500-meter wharf, where vessels of 39 foot draft may berth. The mole at Port de Verdon is to be 300 meters long, capable of taking three or four liners at a time. Two new docks are also to be built at St. Nazaire when circumstances make it advisable, one for shipbuilders and the other for incoming liners. Latter to be 800 meters long and 400 meters wide.

Tokio Harbor Developments.—Municipal authorities of Tokio have decided to expend sum of 350,000,000 yen on harbor improvement works.

New Pier at Port Melbourne, Australia.—Harbor Trust Commissioners have adopted proposal to construct a new pier at Port Melbourne, to relieve pressure of traffic on existing pier.

Launching of the Durenda, Port Glasgow, Scotland.—The second motor vessel built to the order of the British India Steam Navigation Company, the Durenda, was launched from the yard of Robert Duncan and Company, Port Glasgow, Scotland, recently. The length is 465 feet over all, beam 58 feet, and the length brake power 450 feet. Two eight-cylinder North British Diesel engines will be installed, with cylinders 26½ inches diameter and 47 inch stroke, having a speed of revolution of 96 per minute. Electric power will be used throughout for auxiliary purposes. Another vessel is being built for the British India Steam Navigation Company with the same dimensions as the Durenda.

BUSINESS NOTES

Metal & Thermit Corporation, New York, announces the removal of its Pittsburgh branch office from 1427 Western avenue, to 801-807 Hillsboro street, Corliss Station, Pittsburgh, Pa.

L. B. Pickering, of Newport News, Va., has been sent to the New York office of the Newport News Shipbuilding and Dry Dock Company to represent the shipyard's repair department there. It is the first time the shipyard has established such an office in New York. Mr. Pickering has been with the shipyard many years. He is a United States Naval Academy man.

The Shipping Board has established seven inland office divisions with Louis F. Klein of New York as manager. One of the most important offices will be in Chicago. The other interior offices will be at Detroit, Minneapolis, St. Louis, Memphis, Kansas City and Cincinnati.

STEAMSHIP INTERESTS

Announcement has been made by the M. H. Tracy & Company, New York, of a fortnightly intercoastal service, the first sailing to be June 1. It is reported that the company may include in their list of direct ports of call on the Pacific coast, those ports recently eliminated by the westbound conference, among which were San Diego and Tacoma.

The Ward Line inaugurated on May 18 a passenger and freight service between Tampico, Vera Cruz and New Orleans. Every two weeks the *Yucatan* will leave New Orleans. The ship will go to Tampico via Vera Cruz but will go direct from Tampico to New Orleans on the return trip.

Two additional river steamers have been purchased by the Buxton Line, Norfolk, Va., and service between Norfolk and Richmond will be put on a daily basis. There has been no daily service on the James River since the former Old Dominion Steamship Company abandoned the line two years ago.

Announcement has been made by the Isthmian Steamship Lines, Inc., New York, of a regular service between New York and ports of South and East Africa, beginning with the steamer *Birmingham City* sailing on June 20 for Cape Town, Algoa Bay, East London, Port Natal, Delagoa Bay and Beira.

Starting with the sailing of the steamer *Taiyo Maru* May 11, the Toyo Kisen Kaisha inaugurated a new route for its steamers from San Francisco to the Orient by way of Formosa, allowing the passengers a day stop over at this port. The company's freight steamers making tours of the world will make calls at Australian ports hereafter, thus inaugurating the first Japanese service route via Australia.

With the sailing of the steamship *El Mar*, formerly of the Morgan Line, from pier 27, North River, New York, a direct freight service between Portland, Maine, and New York was resumed May 22. The Portland and New York Steamship Company expects to maintain bi-weekly sailings from each port. The company is offering freight rates lower than those for rail hauls between the two ports. Other ships will be added as the cargoes offered warrant the increase.

General Pacific coast agents for the American-Hawaiian Line, New York, have announced that the westbound sailings of the steamers of the line will be increased from a fourteen-day schedule to a weekly basis.

With the steamer *North Star* inaugurating a system of lakes-rail-ocean communication, the northwest was brought nearer to Europe with the arrival of the ship at Chicago. The vessel is one of 24 steamers connecting Buffalo, Erie and Detroit with the terminals of western roads at the west of the lakes. The fleet will accept export bills of lading from any interior points with railway connection to Chicago for shipment to Liverpool, and other European ports via the Lehigh railway from the east ports of the lakes to New York and ocean steamship lines the rest of the way. Opening of the lakes-rail-ocean traffic has made possible rates ranging less than corresponding rail rates for shipments to or from the interior, according to company officials.

The New York & Porto Rico Steamship Line has reduced its passenger fares between New York and ports of Porto Rico. The company's sixteen-day cruise around the island, which for years has been a popular vacation feature, is reduced from $180 to $150 for minimum accommodations and the one-way fare from New York to San Juan is now $65 instead of $75. These reductions are permanent.

The Portland & New York Steamship Company has inaugurated a direct freight service between New York and Maine. This service was very much used by shippers and receivers for many years prior to its discontinuance in 1917.

TRADE PUBLICATIONS

Electric Rivet and Metal Heaters.—The story of the development and application of Berwick electric rivet heaters is contained in a well illustrated catalogue which the American Car and Foundry Company, New York, has recently published. Since 1912 the company has been experimenting with devices for heating rivets electrically and in November, 1919, machines for this purpose were perfected. Complete details of the various types and capacity heaters are given with comments from railroads, boiler shops and other shops where the heaters are used. Information is given on automatic heaters which are now being developed for heating bolt blanks, drop forgings, bar stock 20 to 30 feet in length of any cross sectional area from 3/8 inch diameter up to 1½ inches, for spot welding and the like. The company is also interested in developing electric heaters for practically any special requirement and will be glad to supply the catalogue on request.

Boiler Tube Thimbles.—A folder describing the method of installing boiler tube protection thimbles has recently been sent out by the American Boiler Tube Thimble Company, Providence, R. I.

Copper and Brass.—The April bulletin of the Research Association of the Copper and Brass Industry, New York, contains information on the relative merits of copper and aluminum electric conductors. The subject of brass hardware and the use of brass pipe are taken up in detail.

Forty Years of Progress.—The history of the forty years' growth of the Heine Boiler Company, St. Louis, Mo., and the announcement of the change of name from the Heine Safety Boiler Company and of the new control are given in a bulletin just sent out by the company. Various types of Heine boilers are also briefly described. It is the purpose of the company to extend the assistance of its facilities and engineering service to all those who design, erect and operate power plants in which Heine boilers are used.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander J. S. Evans, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

Marine Engineering and Shipping Age

Volume XXVII July, 1922 Number 7

Publihed Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
S. M. PHILLIPS, Associate Editor L. S. BLODGETT, Associate Editor
W. Z. GARDNER, News Editor

Contributing Editors

Rear Admiral C. W. Dyson, U. S. N.
Commander S. M. Robinson, U. S. N.
Professor C. H. Peabody
Captain C. A. McAllister, U.S.C.G. (Retired)
William Gatewood
H. McL. Harding
William T. Donnelly
James L. Bates

WE GUARANTEE that of this issue 5,450 copies were printed; that of these copies 3,964 were mailed to regular paid subscribers, 346 were provided for counter and news company sales, 212 were mailed to advertisers, 29 were mailed to employees and correspondents and 899 were provided for new subscriptions, copies lost in the mail and office use; that the total copies printed this year to date were 38,450—an average of 5,493 copies a month.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers. Inc., New York Business Publishers' Association and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

"To Be Or Not To Be?"

THE time for Congress to answer the merchant marine question yes or no has arrived. It must soon divulge whether or not it meant what it said in the preamble of the Merchant Marine Act of 1922 when it declared that it was the policy of the United States to develop an American merchant marine, under private ownership, adequate in size to meet our commercial needs in time of peace and to serve as a naval auxiliary in time of war, and that it, Congress, would do everything possible to attain this end. What are the indications?

The subsidy bill was introduced in the House by George W. Edmonds on June 14 and then referred to the Committee on Merchant Marine and Fisheries. This committee favorably reported the bill back to the House on June 16, the vote being 9 to 4. While such prompt action is not an assurance that the House will pass this legislation, nevertheless, it is a strong indication, when a committee, which has given careful study to a measure is so overwhelmingly in favor of it, that the necessity for its enactment into law will be just as apparent to Congress as a whole when it gets the opportunity to analyze and discuss the merits of the act.

Necessity alone, however, is not a sufficient reason, we are sorry to say, for anyone to expect favorable action from Congress. There must be a strong demand backed by the public opinion which in the last analysis is the real government of every civilized nation in the world today.

From no one is this demand more insistent than from our "first citizen," President Harding. True to his pre-election pledge, he has caused to be conducted one of the most complete and exhaustive studies on the shipping situation ever made. In this investigation the best known specialists in the marine field were called into consultation irrespective of their political affiliations. He has taken their facts and findings and presented them to Congress in a special message. He now demands that Congress take action on the shipping bill during the present session and should such action not be forthcoming, he has declared that he will exercise his prerogative and call a special session of Congress solely to consider this measure so vital to our merchant marine.

Following the lead of the President, by far the largest number of influential newspapers have expressed themselves editorially in favor of the subsidy. In a canvass of 300 of the leading papers the National Merchant Marine Association reports that over 70 percent favor this measure. The shipping bill is not only receiving a large amount of editorial comment but it is also obtaining a tremendous amount of publicity in the news columns. Who ever saw so much space devoted to shipping legislation before? Front page stories and feature articles particularly in the newspapers of the interior are the strongest indication that the farmer, the manufacturer, the business man and the working man recognize that the American merchant marine will benefit themselves as well as those who live on the seacoast.

The endorsements that the subsidy bill has received from trade organizations, commercial bodies and chambers of commerce from all over the country and representing every phase of industry—agriculture, mining, manufacturing and business—ought to convince Congress and are in fact one of the best indications that the time for action is not to be deferred. The opponents of the bill are playing for time, knowing full well that they cannot defeat it, if action is taken now. Foreign propaganda and stubborness, however, will not avail; it is now or never for our merchant marine and it is going to be now.

Speaking of Discrimination

IN view of the apprehension that has been expressed by some of the opponents of the pending Shipping Bill that many of its provisions would offend other countries and thus invite retaliation, it is interesting to note the inducements that Canada offers to American manufacturers to establish branches in that country.

According to the Shipping and Exporting Register of Canada, Canadian-made goods get preferential advantages in British Empire countries as well as the benefit of trade agreement with certain foreign countries. Great Britain grants a rebate of one-third duty on certain articles, including motor cars, musical instruments, clock and cinematograph films, and one-sixth duty off numerous other articles. Mr. Lloyd George states that as articles are added to the tariff, preference will be extended to British Empire countries. The subject is listed for the next Imperial Conference.

"British Colonies in the West Indies, British Honduras, British Guiana and Central America give Canada a preference ranging from 10 to 50 percent. New Zealand imposes a surtax on goods from non-British countries averaging 12½ percent as well as a preference of about 10 percent. Cyprus gives one-third off on certain goods and one-sixth off on a large list of articles. Australia, Hong Kong and Shanghai are traditionally fore-disposed to trade with British Empire countries and have preferential measures under consideration."

The above list contains governmental regulations only. The preference given to British shipping by combinations of British banking and commercial organizations similar to that which caused the recent Egyptian cotton controversy are still more effective. Rebates have been in vogue for years. We will never have a merchant marine of our own until Congress grants sufficient protection to meet our competitors "on all fours."

Prohibition On The High Seas

The question of whether or not liquor shall be sold on American vessels outside of the three-mile limit is one thing, but an agitation on the matter started by the executives of the Anheuser-Busch Brewing Company at a time nicely calculated to embarrass the pending shipping legislation is quite another.

We do not believe that the Messrs. Busch were actuated by any desire to aid the cause of prohibition or American shipping. On the contrary, it looks very much as though they hoped to start something that would eventually result in a modification of our laws so that they could resume their erstwhile business of the manufacture and sale of lager beer in this country.

They must know that, if American passenger ships are forbidden to serve liquors, it will not make the seas any drier. The only effect will be to drive prospective travelers to take passage in ships flying foreign flags. This means not only the citizens of other countries who are accustomed to the daily use of wine and liquor but also a large percentage of American travelers as well.

The Shipping Board has taken the ground that the eighteenth amendment does not apply to American ships outside of the three-mile limit. This decision is largely based on rulings of the Supreme Court to the effect that American ships are not a part of the territory of the United States except in a figurative sense. "Seamen employed on them cannot be said to be working in the United States. They are subject to the jurisdiction of local authorities in foreign waters for the punishment of crimes committed on board in such waters. Neutral merchant ships may be seized on the high seas and condemned by belligerents for carrying contraband of war. They may be seized, attached and sold under process in rem for claims in tort, or for debt in our own or in a foreign country. Political refugees may be removed from them when they are in foreign waters."

The above reasons ought to be sufficient to justify the Shipping Board in refusing to forbid the sale of liquor on American ships outside of the three mile limit but there is a grave danger that a bill will be introduced which will clearly put our ships under the restriction of the Volstead Act. But, if Congress feels that it is necessary or desirable to do this, it should make the law read that no merchant vessels whether *foreign* or domestic upon which intoxicating liquors are sold shall enter the ports of the United States, for in no other way can they prevent those who travel to and from our shores from obtaining all the booze they want en voyage.

A Dangerous Opponent

The *New York Journal of Commerce* which recently issued a Shipping Supplement with the aid of and in conjunction with the *Manchester Guardian* (England) and whose revenue is largely derived from the advertisements of foreign shipping companies is trying its darndest to defeat the Shipping Bill or at least delay action on that measure until our merchant marine is as dead as the proverbial door nail.

In an editorial appearing in its issue of June 5 entitled "Subsidies and Treaties"—what subsidies have to do with treaties, by the way, is not explained—it says "competent men" (foreign or American?) "engaged in the shipping business assert that there is no reason why well managed American vessels cannot compete without subsidies and in fact we have at times carried as much as 50 percent of our foreign trade in our own bottoms."

When a daily newspaper, published in our greatest seaport and devoted to the commercial business and knowing full well that we have not had a privately owned merchant marine worthy of the name for seventy years makes a statement like this it is high time that its American patrons should question the sincerity of its often expressed solicitude for the welfare of our shipping.

The Shipping Board at the recent hearings furnished statistics showing that but 5 percent of our overseas commerce was then being carried in privately owned American bottoms and the *Journal of Commerce* in bringing up as a criterion a short period of time after the war when anything that could stay afloat could secure a cargo at an abnormally high freight rate is certainly not trying to present a true picture of the actual situation.

The very title of the editorial "Subsidies and Treaties" is bound to create the impression that we cannot assist our ships financially without breaking our diplomatic obligations. Having got this thought in the headline, which is as far as many of its readers go, it states in the middle of the editorial that "cool headed foreign competitors recognize that they have no basis for complaint, if the United States chooses to empty its Treasury into the pockets of shipowners."

One would think that some concern would be expressed at

the present drain on the Treasury which will continue as long as the Shipping Board is unable to dispose of its vessels, but on this subject it is silent.

The editorial, however, does give us an (encouraging?) suggestion. It says that there are no worse discriminations against American shipping than those that are practiced by some British territories. And, if we will only forego the indirect aids proposed in the Shipping Bill and devote our energies to requesting the stoppage of these discriminations, there is no doubt that we could obtain their abolition in a short time.

This sounds fine, but our legislators had similar information very much in mind when they framed Sections 28 and 34 of the Jones Act. Is it to be expected that foreign countries would be impressed with a promise not to enact legislation when for over two years discriminatory laws have been inoperative on our statute books?

Foreign Shipping Investments

EVER since Commodore Vanderbilt withdrew his money from shipping to invest it in railroads, giving as an explanation that he would rather make 6 percent than 3, it has been very difficult to interest capital in steamships flying the American flag.

Of course, the rapid developments that have taken place in the interior and western portions of this country have given many opportunities for secure investments at large profits; nevertheless, we have financed one of the greatest steamship companies in the world, namely, the International Mercantile Marine Company which has about 90 percent of its vessels registered under foreign flags. The fact that 93.5 percent of the stock in this company is American owned, according to a sworn statement made before the Shipping Board last October, is ample proof that our investors are not adverse to putting their money into the steamship business providing they can be convinced that it can be operated on a sound and profitable basis.

Over twenty years ago, when the International Mercantile Marine Company was formed, it was a wise and farsighted policy to purchase the finest ocean liners in the world, even though they were under foreign flags. The transaction met with general approval in this country and general disapproval in England, which was so intense in that country that the *Lusitania* and *Mauretania* were practically presented to the Cunard Line.

Many advantages have come from this transaction, not the least of which is the experience gained in steamship operation. The past is past but what can we say now to justify ourselves to future generations at the spectacle, when private capital is so urgently needed to purchase and operate American ships, of foreign steamship companies that are unable to raise money in their own country coming over here and floating their securities with apparent ease?

Only this spring we invested $7,360,000 in 25 year 6 percent bonds of the Holland-America Line which that company declared was desired for the purpose of new steamship construction. In May we invested $5,000,000 in 15 year 6 percent bonds of the Scandinavian American Line, which were heavily oversubscribed in one day. Both of these companies are competitors of American shipping and still we aid them to build the very type of vessels that we so urgently need to balance our fleet for commercial purposes and to prevent the 5-5-3 naval ratio from becoming a joke as far as naval auxiliaries are concerned.

In view of this, how can anyone say that shipping would not be an attractive investment to the American public provided it receives the proper Government aid? And, of far more importance, how can anyone say that American shipping does not need protection when foreign steamship lines can easily obtain all of our money that they want while the Shipping Board is finding it most difficult to sell either its ships or its securities and American shipping loans are almost impossible to float?

Agamemnon and Mount Vernon

THERE is no one more aware of our lack of fast passenger ships than the chairman of the Shipping Board. It is largely due to his efforts that the *Leviathan* is now being reconditioned into the finest ship afloat. When finished, however, she will be the only liner that we will have in service capable of maintaining a sustained sea speed of 22 knots or over.

One ship alone cannot maintain an efficient express passenger service and it will therefore be necessary either to match the *Leviathan* with some such ship as the *Columbus* of the North German Lloyd Line or to recondition the *Agamemnon* and *Mount Vernon*. Each of these two ships is capable of making 22 knots or better and they can be fitted out for about $2,500,000 apiece in eight months' time in any of our well equipped shipyards.

In the January issue of Marine Engineering and Shipping Age, we published an article analyzing the economic possibilities of these two ships and there were several well known shipping men at that time who favored reconditioning the *Agamemnon* and *Mount Vernon* in preference to the *Leviathan*.

It was pointed out, however, that the Shipping Board expected to be in a much stronger financial position on the first of July, which is apparently the case, and it was hoped that the President's plan for aiding the development of our merchant marine would be in force. Therefore, we did not feel that it was a case of the *Leviathan* versus the *Agamemnon* and *Mount Vernon* but simply the *Leviathan* first and the other two following.

These two ships are still lying at their dock. So far as we know there has been no definite policy in regard to their disposition adopted, although it is reported that they are about due for serious consideration. We cannot sell them to a foreign company for they would be immediately fitted out and placed in competition with our own vessels and, if it would pay a foreign company to do this, why should we hesitate?

It is not necessary to recondition these vessels in as luxurious a manner as the *Leviathan*. If they are provided with a standard of passenger accommodations equal to those in the *George Washington* or are based on what a conservative steamship owner would spend under like conditions, they will make a very satisfactory addition to our fleet.

The Close of the Battle for Independence on the Seas

Claims of the Opponents of the Ship Subsidy Bill Prove Groundless—Facts and Patriotism Will Win the Fight

By "Old Scotch"

FROM time immemorial a country's shipping has been considered the ward of the nation. It is unlike every other kind of national industry, in that it must necessarily be conducted away from home. If it thrives without direct or indirect aid, all well and good but, if any maritime nation finds that its shipping engaged in transacting its overseas trade cannot be self-sustaining, the business of that nation will not succeed unless its undivided support is given to maintaining sufficient ships to conduct its just proportion of foreign trade.

These economic facts have gradually sunk into the minds of the American people. The long hearings conducted by the joint Congressional committee on the pending subsidy bill have not brought out much that was not already known concerning our shipping situation and, as a whole, the results may be summed up as giving conclusive evidence that national assistance must be given to our ships or they cannot compete with their foreign rivals.

Opponents' Claim Highly Fallacious

A weak effort has been made to prove that our fleet, having a greater proportion of oil-burning vessels than that of any other nation, must necessarily have, on that account, sufficient advantage to overcome the other differentials in cost. In the days of relatively high cost of coal and low cost of oil, there might have been some grounds for such a contention. Now, however, the claim is highly fallacious, as those of us who are familiar with existing and probable future conditions are quite confident that in steam vessels there will probably be a number of conversions from oil burning to coal burning in the not distant future.

The burning of oil for steam production on land or sea is even now against economic conditions, when we take into consideration the limited known supplies of oil and the enormous annual increases of consumption of gasoline and other motor fuels. In the writer's opinion, another decade will see a great diminution in the number of oil-fired steamers and a great increase in motor driven vessels. With our dwindling supplies of oil, there can be no question as to the substitution of motive power which uses only one-third of a pound per horsepower hour for steam machinery which, at the best, uses one pound of oil per horsepower hour.

Fuel Issue Failed Dismally

So, we may as well dismiss the idea that American merchant vessels have any advantage over foreign fleets, because of the larger use of oil as fuel. On the contrary, because of our lack of progress in the adoption of Diesel engined vessels we are at a decided disadvantage with other nations, if we consider the fuel costs of operation.

This matter of fuel seems to have been the main issue raised by the opponents of the subsidy bill, and in that they have failed dismally. There remains no outstanding feature of the opposition to which any credence can be given by those inclined to vote against the pending bill.

A Mild Attack of "Buck Fever"

At this stage of the proceeding, the friends of the measure are going through a mild attack of what is known as "buck fever." That is entirely human and occurs to everybody who attempts to do anything out of the ordinary, which requires fortitude and persistency. We who advocate the measure are convinced that we are right and that it is a just bill, warranted by every condition which goes to make us a happy and prosperous nation. Why then become alarmed because of the various press stories which emanate from Washington as to the "grave doubts entertained by Congressional leaders" as to the ultimate passage of the bill?

True it is that members of the Senate and House who must come up for re-election in November next are apprehensive of every action they take in regard to the important bills now being considered by Congress. They always are at this stage of the proceedings, so far as that is concerned. In the matter of the ship subsidy bill they need have no alarm, if they vote for it; rather they should have some fears, if they vote against it.

The American people far and wide have been well educated on this subject in the past five years. It is naturally very difficult to gage public opinion in a vast country like ours, the only logical method being to appraise the editorial policy of the leading newspapers, as our public press taken on the whole both molds and reflects public opinion on great national subjects. It would be valueless to the average Senator or Congressman to know that the majority of papers in New York and San Francisco favored the subsidy bill, as the answer is that, being important seaports, they quite naturally would favor anything of benefit to shipping. The National Merchant Marine Association, with its headquarters at Washington, has recently performed a very valuable service towards ascertaining what the general sentiment of the country at large is towards this bill.

Press and Commercial Bodies in Favor of Subsidy Bill

Their poll covers the leading newspapers published in 43 different states. These papers, 300 in number, represent all shades of political affiliations, and it is most encouraging to learn that of that number 193 have expressed themselves unqualifiedly in favor of the subsidy bill, 77 were against and 30 were non-committal. Therefore, over 70 percent of the leading journals throughout the country are on record as favoring the passage of the bill.

Another barometer, second only to the public press, is the attitude of the leading commercial organizations throughout the country. These have, with but a very limited number of objections, gone on record as heartily in favor of the proposed direct and indirect aids. The United States Chamber of Commerce, representing commercial organizations throughout the entire land, at its recent national convention announced itself in favor of establishing and maintaining a merchant marine "of a capacity sufficient to transport at least 60 percent of the cargoes entering into American overseas commerce," which is exactly what is aimed at in the Jones-Greene bill. A special committee of the Chamber, composed of leading business men, after making an exhaustive inquiry into the subject, concluded its recommendations with the very logical statement that "To surmount the difficulties that lie before us will require time, patience, perseverance and the free exercise of those other qualities that have in other fields of endeavor led the American people to success. The committee doubts neither the results nor the justification of all the effort required to attain it."

Apprehension as to Passage of Bill Groundless

Backed as the measure is by the press, the great commercial organizations and an aroused public sentiment, we should

enter the close of the fight, when definite action is to be taken, without apprehension as to the ultimate results. "Let the heathen rage," the heathen being in this case those who are against our having a merchant marine for their own sinister self-interests. There is no occasion for the "buck fever," which seems to have seized some of the friends of the bill. During the recent centennial anniversary of the birthday of General Grant, many anecdotes were printed concerning that great military leader's life and acts. None was more interesting than one quoted from the General's own memoirs, and which is particularly applicable to present moment contemplation of the forthcoming battle in Congress.

It seems that young Grant had no fears at all in the many one-sided engagements in which he participated during the Mexican war. In his more mature years, after being placed in command of the Union troops about to begin fighting in Missouri, he proceeded to attack a strong Confederate position in the central part of the state. Upon approaching within four or five miles of where the battle should take place, the General admits that he was seized with a great feeling of apprehension, almost approaching cowardly fear. Being in command, he realized that it would not do for him, of all men, to show the white feather, so summoning all his will power he ordered the advance on the enemy. Arriving at the place where the opponents were supposed to open fire, he found that during the preceding night the enemy had decamped bag and baggage. "Then and there, I determined," said the General, "that the other fellow was even more scared than I was." So ever after that, throughout all his battles, the element of fear never entered his calculations.

While it is not expected that the enemy will fold up their tents and decamp, at the approaching subsidy battle in Congress, there is nothing for us to fear as to the result. After their "hot air barrage" of general debate on the bill has been exhausted, it will be found that the enemy has no heavy guns to bring into action. They are lacking in the ammunition of facts and patriotism, which are the essentials of winning a battle of this kind.

American Farmers and American Ships

Both the Farmers and Their Soldier Sons Recognize Folly of Depending on Foreign Nations for Ocean Transport

By Winthrop L. Marvin*

MOST of the farmers of this country—and particularly those farmers whose domiciles are between the Ohio River and the Rocky Mountains—do not dream of the conspicuous part which they have been playing this year in sundry European journals devoted to commerce and finance. When the United States Shipping Board last autumn began to prepare information for use in the lining out of a constructive National shipping policy, the editors of the transatlantic mercantile press instantly sat up and took notice. They began straightway to wonder and conjecture what the new American shipping legislation would be like, and when President Harding, with definite proposals at hand, made his eloquent appeal to Congress for an American merchant marine competent to serve the country in either peace or war, a very unmistakable agitation appeared among those overseas interests that had been monopolizing for many years nine-tenths of the ocean carrying trade of the American people.

They did not relish this demonstration that the Americans were preparing to "consolidate" an independent merchant shipping position of their own. The journals of European commerce confessed a fear of the consequences of President Harding's proposal that 50 percent of the immigrant traffic into the ports of the United States should be conveyed in American passenger vessels, or the plan for a deduction from the Federal income taxes of shippers of 5 percent of the freight moneys paid on goods transported in American ships. An American building fund for the encouragement of shipping, it was felt, might have something of the same results as the fund from the British treasury which built the *Mauretania* and *Lusitania*. And finally there was undeniable danger to European dreams of continued maritime monopoly in the mail subventions to fast liners and the subsidies or "compensation" to cargo ships of the United States engaged in international commerce.

Creates Consternation Abroad

There was almost a panic in maritime circles abroad when the National shipping bill was introduced. It was so unexpectedly far-reaching, so ingenious, so "adroit." Moreover, there was such a quick and formidable response to the appeal of the President from American manufacturers, merchants and bankers.

But those who presided over the destinies of the organs of European commercial and maritime interests found one consolation in the thought or hope that President Harding's constructive shipping program would be opposed and might be defeated by "the Western farmers" and "the Democratic party." These two influences were eagerly invoked in the European press as the faithful and sure protectors of European interests. In all of which those wiseacres who were commenting on the American shipping legislation overseas showed that they were not entirely acquainted with either the farmers or the Democratic party. There are a great many good Democratic citizens in this country of ours who want to see an American merchant marine and naval reserve just as earnestly as any Republican followers of President Harding. There are also hundreds of thousands of American farmers who have understood the problem of the merchant marine and have held the same convictions about it as have their salt water fellow countrymen.

It is a mistake to assume, as not only these European editors and statesmen but even some onlookers in this country have been doing, that "the farmers" are necessarily opposed to National aid for American ships. Many farmers are opposed, without question. But the curious observer who will turn back to the files of the *Congressional Record* from 1900 to 1908 and thereabouts, when the Frye-Hanna and Gallinger shipping bills were under consideration, will discover that the majority of the senators and representatives in Congress from the Middle West, or at least the majority of those of the Republican persuasion, spoke and voted for the constructive shipping policies of McKinley and Roosevelt. It was only a minority of those senators and representatives who were against the policies—but this minority, combined with the almost solid Democratic opposition of the time, was able to turn the scale against American shipping legislation by a narrow margin of from three to seven in the House of Representatives.

*Vice-president and general manager of the American Steamship Owners' Association, New York.

The farmers of America, taking them as a whole, are not less intelligent or less patriotic or less far-sighted than other Americans. The great majority of our farmers live far from the sea. With the building and handling of ocean ships they are not acquainted. But they are also reading men and thinking men in the same degree as other great classes of our citizens, and the specious plea of European ship monopolists that foreigners be allowed to carry our ocean trade because they can do it "more cheaply" has not deceived all of these farmers by any means, or even at any time a majority of them.

In the recent hearings on the Shipping Bill before Congress, what is regarded as the soundest and strongest of the farmers' distinctive organizations, while not enamored of the word "subsidy," came out through its chief executive for the passage of the Harding Shipping Bill. There are particular reasons, and very strong compelling reasons, why the farmers of the country at large, North and South, have a great deal at stake in the development of an adequate merchant marine. In grain, cotton, provisions and some other things, American farmers have a considerable surplus of products beyond the consuming power of America herself. These goods must be exported, in order that the farmers may realize proper compensation for their labors. For the export of these surplus products ocean ships, operated on dependable, regular schedules, are essential, and for the fullest protection of the farmers' interests these ships must be built, owned and controlled in the United States, so that they may be available in peace or war to serve "America first."

Scarcity of Ships Remembered

This is exactly what the American farmers did not have in 1914. On the contrary, it was the ships of Great Britain, Germany, France, Italy and Japan that were then carrying all but a small fraction of our ocean commerce. What happened on the outbreak of the war is keenly remembered. The German ships, of course, were immediately captured or laid up. Those British ships which the British government required for war purposes were immediately ordered home. So were the ships of France and later of Japan and Italy. Then there came to the American farmers—to the growers of wheat and growers of cotton—a sharp realizing sense of the essential humbug of the proposition, "Let foreigners carry our trade—they can do it so cheaply!"

Instead of "cheap," this infatuated dependence on foreigners instantly became exceedingly dear. Because there were so few foreign ships left in our commerce, and because only a handful of American ships were available, freight rates on the export of our wheat and cotton to Europe were straightway raised to an unheard-of altitude. In July of 1914, a month before the outbreak of the war, the freight rate on grain from New York to the United Kingdom was four or five cents a bushel. By December, 1914, this freight rate had advanced to 16 or 17 cents a bushel—an increase of about 300 percent. To the Continental port of Rotterdam before the war the freight rate on grain from New York had been 6¼ cents a bushel. In December, 1914, it had reached 30¾ cents a bushel—an increase of about 400 percent. So with cotton. Most Southern senators and representatives before the war had voted doggedly against any National aid or encouragement to the merchant marine. They were very severe in their strictures on the "subsidists." They were fond of arguing as a whole that foreigners ought to be allowed to transport our cotton because they could do it "so cheaply!"

The freight rate on cotton from New York to Liverpool before the war was 20 cents a hundred. In December, 1914, it was 75 cents a hundred. The freight rates on cotton from the Gulf to Rotterdam, like the freight rates on grain, had increased 400 percent.

And this was not the end; it was only the beginning. Month after month, as the folly of dependence on foreigners for ocean shipping bit more and more deeply into the consciousness of the American people, freight rates on grain and cotton to Europe, still dominated as they had been before the war by alien interests, kept on increasing by leaps and bounds—and the Democratic Secretary of the Treasury in the cabinet of President Wilson was proclaiming to the country that dependence on Europe for the sea transportation of our products was a policy that was costing the American people many hundreds of millions of dollars a year!

Heavy Toll Exacted by Foreign Steamship Owners

"From every Atlantic and Gulf port," declared Secretary McAdoo to an audience* in the city of Chicago, "there comes the cry of scarcity of ships and exorbitant rates. These enormous increases in rates," Mr. McAdoo added, "constitute a heavy tax on the American producer. They are reflected in the lessened prices which he has been compelled to take for his product. The increased cost of carrying American produce and commodities to European ports since the war broke out runs into millions." And he added impressively, "This great sum represents a heavy toll that has been exacted by foreign steamship owners from American shippers and producers. It is in effect a penalty they are paying for the failure of American politicians to carry out their repeated promises to the American people. Foreign owners may increase their rates overnight arbitrarily—we have no power to prevent it—and we must pay the price or stop our shipments!"

Secretary McAdoo, a fervent Democrat and a red-blooded American, placed the blame right where it belonged—on the avaricious "foreign steamship owners" and on the American politicians who had failed "to carry out their repeated promises to the American people."

Because it was the farmers of the West and of the South who had the bulkiest products for export—products which absolutely had to be shipped abroad—it was these Western and Southern farmers who were the heaviest sufferers from the lack of an adequate American merchant marine.

To say that these farmers have forgotten their experience of 1914-1918, and that they now have no interest in American ships, is to accuse them of a lack of intelligence of which they are emphatically not guilty. They remember—and their soldier sons remember. For when in self-defence the United States herself entered the world war, and it became necessary for our nation to find ships to send its own boys overseas, the poverty of the American merchant marine and the unconscionable folly of depending on foreign nations for ocean transport in peace or war became even more astounding than before. Because there were so few American ocean passenger steamers it was necessary for the government hurriedly to fit cargo steamers of relatively low speed and to improvise all kinds of transport craft, with the result of an immensely increased hazard of destruction by the German submarines. And to make matters still worse, when the painful scenes that accompanied the torpedoing of the *Antilles* and the *Finland*—the rush of panic-stricken foreign seamen to the boats, leaving the soldiers and the sick behind—compelled the Navy Department to issue a command that all merchant transports should be manned by the 100 percent Americans of the Navy, there had to be ordered to these transports raw sailor recruits from the prairies and the cotton fields who had never seen a ship before they donned the blue, and, of course, were totally without experience as seamen.

Somehow—thanks to the too-small trained personnel of the regular Navy—we did manage to muddle through and get the boys across. But the awful peril of that situation is not yet forgotten, and never will be forgotten by the American people. Hundreds of thousands of young Western and Southern soldiers and seamen who traveled the road to

*Address of Hon. William G. McAdoo before the Commercial Club of Chicago, January 9, 1915.

(*Continued on page* 421)

Revised Ship Subsidy Bill Analyzed

Member of Merchant Marine and Fisheries Committee Explains Features of Bill as Reported to the House

By Congressman George W. Edmonds

I AM naturally proud of the work of my sub-committee. This bill, together with the Shipping Bill, 1916, and the Merchant Marine Act, 1920, will make a record of constructive legislation upon a comparatively new subject to the present generation of Americans, which any legislative body could well point to with pride. This bill has required the best that can be collected from the brains of men in many callings, and collectively, if passed by Congress, will mean that 50 or 60 percent of our foreign commerce will be again traveling the seas under the American flag. I say collectively because each section of the proposed bill is interwoven with the other, each having its own particular aid to give, and particular performance to bring into action.

As a whole it is like a house of stone and while made up of many blocks, joined together by proper cement, the completed structure will give the required result. The bill as compared with the bill introduced on February 28, contains the following important changes:

Title I—Section 1

The section in regard to the sale of the vessels has been amended so as to read:

"Public or private competitive sale," also interest on unpaid purchase price has been increased to 4 percent from 2 percent.

Also the following has been added:

"The payments of principal shall be so arranged that the amounts due or paid under the contract of sale as principal up to any moment of time shall be sufficient to cover depreciation of the vessel up to such moment."

Title I—Section 2

New Section 2 provides that in selling the vessels the board should be careful to encourage present lines, particularly those operated by residents of particular communities, so that they may arrange to purchase the ships. It further prohibits the board from selling such vessels to persons outside of the domestic communities for a period of two years, so as to give them every opportunity to consummate their purchase.

Monopoly of ships or ports is declared against the policy of the Congress.

Title I—Section 3

There has been virtually no change in the construction fund except that it has been made explicit that this is a revolving fund; the amount remains at $125,000,000 and the interest not less than 2 percent.

Subsidy Bill Postponed a Month

President Harding informally sanctioned on June 20 a postponement of consideration of the ship subsidy bill in the House for approximately a month, so that Congressmen may have an opportunity to visit their districts and discuss the bill with their constituents. The President regards the plans for establishing an American merchant marine as a big American problem and he wants the people to understand it. "The plan is unfailing in its appeal to the sober judgment of the American people," the President said.

The President still feels that it is most vital to have the question settled at this session of Congress and he will, therefore, continue to insist that Congress express itself definitely before adjourning. If this is not done, the President will carry out his announced plan to call an extra session this summer.—The Editor.

Title II—Section 201

The taxation features in the new bill remain virtually the same. The construction tax deductions are the same as in the Merchant Marine Act, 1920. Only the administrative features have been made more explicit, so that there can be no question of doubt of their operating successfully.

Title II—Section 272

The depreciation feature of the taxation provision of the bill has been explicitly stated so that the depreciation arising out of war conditions can be spread over five years. This will assist in helping out the extraordinary losses in shipping property.

Title II—Section 273

The section containing the 5 percent deduction for shippers on freight paid in American vessels and applicable to their income taxes remains in the bill, the provisions being fully written out in the bill. The doubling of tonnage taxes as provided in the bill are retained in the new bill, excepting that they are not doubled upon power vessels of under 1,500 tons, or sailing vessels of under 1,000 tons, it being contended that these vessels being not subject to compensation should not have the extra tonnage tax to pay.

Owing to treaty obligations there has been a new immigration section placed in the bill. It reads as follows:

Title III—Sections 301 to 304 Inclusive

"Sec. 301. As nearly as practicable one-half of the total number of immigrants, admitted to the United States in any fiscal year, shall be transported in vessels registered, or enrolled and licensed, under the laws of the United States."

"Sec. 302. The Commissioner-General of Immigration with the approval of the Secretary of Labor shall make regulations necessary for the enforcement of Section 301. All such regulations, insofar as they relate to the administration of such section by diplomatic or consular officers of the United States, shall be subject to the approval of the Secretary of State."

"Sec. 303. Section 301 shall not take effect as to immigrants transported in a vessel documented under the laws of any foreign country until a time fixed by proclamation of the President. The President is authorized and directed, whenever in his opinion the provisions of this title or of regulations made thereunder, are or may be in conflict with treaties or conventions with a foreign country, to take such steps as may, in his opinion, be necessary to remove such conflict. Whenever, in his opinion, no such conflict exists

in the case of any country he shall proclaim, and the provisions of this title and regulations made thereunder shall take effect in the case of immigrants transported in vessels documented under the laws of such country at the time specified in the proclamation therefor."

"Sec. 304. The term 'United States' as used in this title in a geographical sense means the several States, the Territories of Alaska and Hawaii, the District of Columbia, Porto Rico, and the Virgin Islands."

The Naval Reserve section has been dropped in the new bill.

Title IV—Section 402

There has been no change in the sources of the fund for compensation:

1. All tonnage taxes and light money.
2. Ten percent of the customs duties.
3. Compensation for first, second and third-class mails.
4. Any amounts returned by the limitation of profits clause.

Title IV—Section 403

Contracts for compensation are limited to 10 years.

Title IV—Section 404

The provisions of the contracts to be made are fully set forth in the bill, and there has been no change in the basic compensation except that the special compensation commences at 12 knots instead of 13 knots as in the original bill.

Title IV—Section 405

All definitions in this section have been carefully worked out so as to cover the contingencies that arise in a business of varied character.

Title IV—Section 406

The compensation limitation as to size of power-driven vessels remains the same, 1,500 tons, but compensation is paid to sailing vessels of over 1,000 tons.

Rating must be made by the American Bureau of Shipping, and a new paragraph has been added requiring one-half of the crew in both deck and engine department to be citizens of the United States.

Vessels built in a foreign country before the passage of this act and essential to the development of an American merchant marine can be transferred to American registry upon agreement by five members of the board, and receive compensation. This privilege is limited to three years from the passage of the act and is intended to admit only those vessels necessary to round out the merchant fleet, and in cases which require expeditious action.

Title IV—Sections 407 and 408

Foreign trade is particularly defined in these sections of the new bill.

Title IV—Section 409

It is required that after three years 75 percent of any owner's tonnage must be American owned and registered under the laws of the United States. This covers affiliated concerns and such concerns are closely described.

Title IV—Section 410

The board has the power upon vote of five members to increase or decrease the compensation when it is found advisable by the circumstances of the case.

Title IV—Section 412

Any vessel which has received compensation may be requisitioned in time of war or national emergency, the vessel so requisitioned or chartered shall receive a fair value for the purchase or service with no enhancement in value by the causes necessitating the taking, the owner shall under no circumstances receive consequential damages arising out of such taking or use.

Title IV—Section 413

Repairs, unless necessary for the safety of the vessel, shall be made in the United States or its territories including the Canal Zone, the exception in this section applies to feeder vessels, which do not travel between United States ports.

Title IV—Section 414

The carriage of the first, second and third class mails is provided for, the Post Office Department still making the contract directly with the vessels for the carriage of the parcels post. No change is made in the regulations, everything is carried on by the Post Office Department as at present excepting that the compensation for its carriage is paid into the merchant marine fund when the carriage is done by vessels receiving compensation from that fund.

Title IV—Sections 415 and 416

When a vessel receiving compensation is sold, its contract for the same is closed unless a new contract is made by the purchaser, with the exception that the purchaser must purchase the vessel subject to the right of the United States to take or use such vessel in emergency for the full term of the contract.

Title IV—Sections 417 to 419 Inclusive

The limitation of compensation is entered into fully in the new bill, and every endeavor has been made to protect the government from the many complications which arise from the many and various business situations that arise from the ramifications to be found in the shipping business.

Titles V and VII

The use of the Army and Navy transports necessary to build up the overseas shipping is continued in this bill as in the original bill, as is also the requirement that government officials use American ships whenever possible.

Title VI—Sections 601 to 603 Inclusive

It is endeavored in the bill to bring about an understanding between the Interstate Commerce Commission and the United States Shipping Board by arranging for a joint committee to clarify the situation in regard to through freight, so that something approaching the correlation between rail and water carriers in foreign countries can be covered in this country by our connecting rail and water lines.

Title VI—Section 604

The bill also clarifies the interstate commerce act by describing under what conditions a railroad can become interested in vessels.

Title VI—Section 605

It also arranges to enlarge the powers given the board by the Shipping Act of 1916 in Section 15 so that a thorough record of agreements between shipping companies, or between shipping companies and other carriers, shall be subject to the approval of the board; this covers all common carriers by water and includes the coastwise business. This section is subject to a heavy penalty for violation.

Title VI—Section 607

In order to make Section 28 of the Merchant Marine Act of 1920 operative, the bill has clarified the section, and it is believed that all delay in placing this section in operation should now be eliminated; as this gives preferential railroad rates to American vessels it will go a long way in assisting in securing the necessary cargo both of imports and exports for our ships.

It is provided in the amendment to Section 28 that the Shipping Board and the Interstate Commerce Commission have the power jointly to suspend the application of the provisions of this section when in their judgment it would operate to the prejudice of any particular port

Complete Text of Revised Merchant Marine Act, 1922

A BILL—To amend and supplement the Merchant Marine Act, 1920, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—AMENDMENTS TO THE MERCHANT MARINE ACT, 1920

SEC. 1. Section 5 of the Merchant Marine Act, 1920, is amended to read as follows:

"SEC. 5. (a) That in order to accomplish the declared purposes of this Act, and to carry out the policy declared in section 1 hereof, the board is authorized and directed to sell, as soon as practicable, consistent with good business methods and the objects and purposes to be attained by this Act, at public or private competitive sale after appraisement and due advertisement, to persons who are citizens of the United States, except as provided in section 6 of this Act, all the vessels referred to in section 4 of this Act or otherwise acquired by the board.

"(b) Any vessel may be sold without such advertisement or such competitive sale, if such action is specifically authorized by the board upon an affirmative vote of not less than five of its members, and if such vote and a full statement of the reasons for authorizing such sale are spread upon the minutes of the board.

"(c) Any sale under this section shall be made at such prices and on such terms and conditions, including the use or disposition of the vessel by the purchaser, as the board may prescribe; except that (1) the completion of the payment of the purchase price and interest shall not be deferred more than 15 years after the making of the contract of sale, (2) interest on the unpaid purchase price shall be payable at least annually at a rate of not less than 4 per centum per annum, and (3) the payments of principal shall be so arranged that the amounts due or paid under the contract of sale as principal up to any moment of time shall be sufficient to cover depreciation of the vessel up to such moment, unless the board waives this requirement upon the giving of adequate security.

"(d) All sales made under the authority of this Act shall be subject to the limitations and restrictions of section 9 of the Shipping Act, 1916, as amended."

SEC. 2. (a) Section 7 of the Merchant Marine Act, 1920, is amended by inserting after the first proviso thereof the following: "*Provided further,* That domestic communities primarily interested in such lines shall be understood to mean the geographical divisions of the coast lines of the United States known as the North Atlantic, South Atlantic, Gulf, and Pacific coasts, together with the particular ports from which such lines may run or be intended to run, and the territorial regions and zones naturally tributary to such ports and coastal divisions: *Provided further,* That the board shall not for the period of two years after the enactment of the Merchant Marine Act, 1922, sell such vessels to persons other than those who have the support, financial and otherwise, of the domestic communities primarily interested in such lines:"

(b) Such section is further amended by adding at the end thereof a new paragraph to read as follows:

"It is hereby declared to be the policy of Congress to discourage monopoly in the American merchant marine, and, in pursuance of this policy, the board is directed, in the development of its sales policy, to continue as far as possible and practicable, subject to the provisions of this section, all existing steamship routes and regular services, and to endeavor in every way to bring about the permanent establishment of such routes and services, and their retention, as far as possible, in the hands of persons having the support, financial and otherwise, of the domestic communities primarily interested in such routes and services. In carrying out the provisions of this section the board is directed to investigate fully all matters in connection therewith, and to conduct hearings at which the persons interested in such communities may have the opportunity to express their views as to the course to be pursued by the board and the methods to be adopted in carrying out the policy herein prescribed."

SEC. 3. Section 11 of the Merchant Marine Act, 1920, is amended to read as follows:

"SEC. 11. (a) That there is hereby established in the Treasury a revolving fund to be known as the 'United States Shipping Board Construction Loan Fund' (hereinafter in this section called the 'loan fund'). There shall be covered into the loan fund all moneys which at the time of the enactment of the Merchant Marine Act, 1922, are in the fund created by this section as in force before its amendment by such Act; and the board may set aside and cover into the loan fund all receipts of the board, except appropriations made by law and profits of the board from the operation of vessels; but the total amount of moneys covered into the loan fund (other than payments upon the principal and interest upon loans made therefrom) shall not exceed $125,000,000.

"(b) The board may use the loan fund, to such extent as it deems necessary, for making loans to aid persons, citizens of the United States, (1) in the construction by them in private shipyards of the United States of vessels of the best and most efficient type equipped with the most efficient and the most economical machinery and commercial appliances, or (2) in the equipping by them of vessels already built with such machinery and commercial appliances.

"(c) No loan shall be made for a longer time than 15 years. All loans shall bear interest, payable at least annually, upon the unpaid principal at a rate not less than 2 per centum per annum. No loan shall be made (1) in the case of a loan for construction purposes, for a greater sum than two-thirds of the cost of the vessel to be constructed, nor (2) in the case of a loan for equipment purposes, for a greater sum than two-thirds of the cost of the equipment or two-thirds of the value of the vessel when thus reequipped, whichever is the lesser. The board shall require such security for the loan, including a first lien upon the entire interest in the vessel with reference to which the loan is made, as it deems necessary in order to insure the repayment of the loan with interest. In case of a loan under this section made after the enactment of the Merchant Marine Act, 1922, all payments upon the principal and interest of the loan shall be covered into the loan fund."

TITLE II—TAXATION

INCOME TAX OF VESSEL OWNERS

SEC. 201. Title II of the Revenue Act of 1921 is amended by adding at the end thereof seven new sections to read as follows:

"EXEMPTIONS TO VESSEL OWNERS

"SEC. 265. (a) That the owner of a vessel of 1,500 gross tons or more (as shown on her certificate of admeasurement), registered, or enrolled and licensed, under the laws of the United States, shall, for the taxable year 1921 and for each of the eight taxable years following, be allowed as a deduction in computing net income, in addition to the deductions allowed by sections 214, 234, and 266, an amount which bears the same ratio to his net income during the taxable year attributable to the operations of such vessel (computed without the benefit of this section) as his gross income attributable to the foreign operations of such vessel bears to his entire gross income attributable to the operations of such vessel: *Provided,* That in no case shall the amount by which the taxes imposed by this Act are diminished by reason of such deduction, exceed 50 per centum of the amount certified under clause (1) of subdivision (b) of this section, plus 100 per centum of the amount certified under clause (2) of subdivision (b) of this section.

"(b) Such deduction shall not be allowed unless the United States Shipping Board (hereinafter in this title referred to as the 'Board') has certified to the Commissioner (1) the amount invested by the taxpayer, after the begining of the taxable year for which the deduction is claimed and prior to the time fixed by law for filing the return, in the building in private shipyards in the United States of new vessels of a type and kind approved by the Board, to be registered, or enrolled and licensed, under the laws of the United States, and (2) the amount set aside by the taxpayer after the beginning of the taxable year for which the deduction is claimed and prior to the time fixed by law for filing the return, in a trust fund for investment in the building in private shipyards in the United States of new vessels of a type and kind approved by the Board, to be registered, or enrolled and licensed, under the laws of the United States.

"(c) As soon as practicable after the filing of the return for the taxable year for which the deduction is claimed, the amount by which the taxes imposed by this Act are diminished by reason of the deduction allowed under subdivision (a) of this section shall be determined by the Commissioner with the approval of the Secretary and certified by the latter to the Board. The Commissioner shall notify the taxpayer, who may immediately withdraw from such trust fund the amount, if any, by which the amount set aside in such trust fund exceeds the amount which should have been so set aside, together with the ratable part of the interest on or earnings from such trust fund since the date of its establishment.

"(d) For the purposes of this section there shall be deemed attributable to the foreign operations of a vessel so much of the gross income attributable to the operations of such vessel as is attributable to the carriage of passengers, cargo, and mails taken on board at a port not in the coastwise trade and discharged at a port whether or not in the coastwise trade, or taken on board at a port whether or not in the coastwise trade and discharged at a port not in the coastwise trade.

"(e) In no case shall the amount by which the tax due from a taxpayer, other than a corporation, is diminished by reason of the deduction allowed by this section, exceed the amount by which the tax would have been diminished if such taxpayer were a corporation.

"(f) That portion of the amount of invested capital attributable to the vessel, which bears the same ratio to such invested capital as the amount allowed as a deduction under the provisions of this section bears to the amount of the entire net income for the taxable year attributable to the operations of such vessel (computed without the benefit of this section), shall be regarded as an inadmissible asset in computing the tax imposed by Title III of this Act.

"SEC. 266. (a) That in the case of the sale, during the taxable year 1921 or any of the eight taxable years following, of a vessel launched prior to January 1, 1914, which was at the time of the enactment of the Merchant Marine Act, 1922, registered, enrolled, or licensed, under the laws of the United States, and which at no time thereafter, up to the time of sale, was under a foreign registry or flag (or, in case of sale made prior to the enactment of such Act, was at the time of the sale registered, enrolled, or licensed, under the laws of the United States), the taxable gain derived from the sale shall be allowed as a deduction (in addition to the deductions allowed by sections 214, 234, and 265) in computing the net income of the owner, if he is a citizen of the United States within the meaning of the Shipping Act, 1916, as amended by the Merchant Marine Act, 1920. Except as provided in subdivision (b) this deduction shall not be allowed unless (after the beginning of the taxable year for which the deduction is claimed and prior to the time fixed by law for filing the return) the entire proceeds of the sale have been invested by the taxpayer, or set aside by him in a trust fund for investment, in the building in private shipyards in the United States of new vessels of a type and kind approved by the board, to be registered, or enrolled and licensed, under the laws of the United States.

"(b) If a part only of the proceeds of the sale has been so invested or set aside in a trust fund, the amount of the deduction allowed under subdivision (a) shall be an amount which bears the same ratio to the taxable gain derived from the sale as the part of the proceeds so invested or set aside in a trust fund bears to the entire proceeds of the sale.

"(c) Upon the completion of the new vessel or vessels they shall, for the purposes of sections 202, 214 and 234, be treated as taking the place of a like proportion of the vessel sold.

"(d) Where a vessel is exchanged for property, or for money and property, the transaction shall, for the purposes of this section, be deemed to be a sale with reference to (1) the money received in the exchange, and (2) that part of the property received in the exchange which, under the provisions of subdivisions (c) and (e) of section 202, is considered in determining the taxable gain from the exchange.

"SEC. 267. (a) That if a taxpayer establishes a trust fund for investment under the provisions of section 265 or 266, the amount so set aside under section 266, or an amount equal to 200 per centum of the amount set aside under section 265, as the case may be, shall be actually invested by the taxpayer, within a reasonable time to be determined by the Board, in the building in private shipyards in the United States of new vessels of a type and kind approved by the Board, to be registered, or enrolled and licensed, under the laws of the United States. Upon failure to invest all or any part of such amount within the reasonable time fixed by the Board, or upon failure to register, or enroll and license, the new vessel or vessels under the laws of the United States within a reasonable time fixed by the Board, the Board shall immediately notify the Commissioner, and (1) the amount which should have been invested under the provisions of section 266 and this section, which is not so invested, or the amount invested in a vessel or vessels not registered, or enrolled and licensed, under the laws of the United States, shall be deemed, for the purposes of section 266, to have never been set aside in a trust fund for investment, and (2) 50 per centum of the amount which should have been invested under the provisions of section 265 and this section, which is not so invested, or 50 per centum of the amount invested in a vessel or vessels not registered, or enrolled and licensed, under the laws of the United States, shall be deemed, for the purposes of section 265, to have never been set aside in a trust fund for investment. Any additional tax due by reason of this adjustment of the amount set aside in the trust fund for investment under sections 265 and 266, together with interest thereon at the rate of one-half of 1 per centum per month from the time the tax was due, shall be payable upon demand at any time, notwithstanding the provisions of section 250. The amount in

the trust fund shall be first applied in payment of such additional tax due, and the instrument creating the trust fund shall provide for such application.

"(b) Whenever the taxpayer establishes a trust fund for investment under the provisions of section 265 or 266, the interest on or earnings from the amount set aside in such fund shall belong to the fund, and, for the purposes of subdivision (a) of this section, shall be considered as being a part of the amount set aside in the fund.

"Sec. 268. That the Commissioner may require a taxpayer, who claims the benefit of the deduction allowed by section 265 or 266 and establishes a trust fund for investment, to furnish a bond with such security or surety as the Commissioner shall require, for an amount not less than the estimated income, war-profits and excess-profits taxes that would have been payable but for the deduction claimed under those sections. Such bond shall be conditioned upon (a) the investment of the fund in accordance with the provisions of section 267, or the payment of the tax, together with interest, due by reason of failure to so invest, and (b) the registering, or enrolling and licensing, of the new vessels under the laws of the United States within the time fixed by the Board.

"Sec. 269. (a) That the amount invested under the provisions of sections 265, 266, or 267, or set aside in a trust fund for investment under the provisions of sections 265 or 266, must be from funds other than any loan which the taxpayer may have received from the Board under the provisions of section 11 of the Merchant Marine Act, 1920, as amended by the Merchant Marine Act, 1922.

"(b) So much of sections 265 and 266 as requires that the investment, or the setting aside of an amount in a trust fund for investment, shall be made prior to the time fixed by law for filing the return for the taxable year for which the deduction is claimed, shall be deemed complied with by a taxpayer with respect to the deduction for a taxable year ending prior to the time of the enactment of the Merchant Marine Act, 1922, if he makes such investment, or sets aside such amount in a trust fund, within 75 days after the enactment of such Act.

"Sec. 270. That section 265 and section 266 shall be deemed to have been in force on January 1, 1921.

"Sec. 271. That the benefits of section 265 and section 266 shall be allowed to the members of a partnership and the beneficiaries of an estate or trust under regulations prescribed by the Commissioner, with the approval of the Secretary."

Sec. 202. (a) Subdivision (a) of section 212 of the Revenue Act of 1921 is amended by striking out the word and figures "section 214" and inserting in lieu thereof the following: "sections 214, 265, and 266."

(b) Section 232 of the Revenue Act of 1921 is amended by striking out the word and figures "section 234" and inserting in lieu thereof the following: "sections 234, 265, and 266."

Depreciation of Vessels

Sec. 203. Title II of the Revenue Act of 1921 is further amended by adding at the end thereof, after the sections added thereto by section 201 of this Act, a new section to read as follows:

"Depreciation of Vessels

"Sec. 272. (a) That in the case of vessels registered, enrolled, or licensed, under the laws of the United States, the reasonable allowance for exhaustion, wear and tear, and obsolescence, provided in paragraph (8) of subdivision (a) of section 214, and in paragraph (7) of subdivision (a) of section 234, shall be determined, and allocated to the years in which sustained, under rules and regulations prescribed by the United States Shipping Board.

"(b) In the case of a vessel of 1,000 gross tons or more (as shown by her certificate of admeasurement), registered, enrolled, or licensed, under the laws of the United States, acquired after August 1, 1914, and prior to January 1, 1921, there shall be allowed for the taxable year 1922 and each of the four succeeding taxable years, a reasonable deduction for the exceptional decrease in value thereof since the date of acquisition, but not again including any amount otherwise allowed under this Act or any previous Act of Congress as a deduction in computing net income. This deduction shall be determined and allocated to the taxable year 1922 and the four succeeding taxable years under rules and regulations prescribed by the United States Shipping Board. At any time before March 15, 1927, the Commissioner may, and at the request of the taxpayer shall, reexamine the return, and if he then finds as a result of an appraisal or from other evidence that the value on which the tentative deduction for exceptional decrease in value was based, was incorrect or has changed, the income, war-profits and excess-profits taxes for the year or years affected shall be redetermined; and the amount of tax due upon such redetermination, if any, shall be paid upon notice and demand by the collector, and the amount of tax overpaid, if any, shall be credited or refunded to the taxpayer in accordance with the provisions of section 252.

"(c) This section shall take effect as of January 1, 1922."

Income Tax Credit For Transportation By Water

Sec. 204. Title II of the Revenue Act of 1921 is further amended by adding, after the section added thereto by section 203 of this Act, a new section to read as follows:

"Credit For Amounts Paid For Water Transportation

"Sec. 273. (a) That the tax computed under this title (less the credits provided by sections 222 and 238) shall be credited with an amount equal to 5 per centum of the amount of freight money paid (not accrued), by the taxpayer and for his own account, during the taxable year and after the enactment of the Merchant Marine Act, 1922, for the transportation after the enactment of such Act in a vessel, registered, or enrolled and licensed, under the laws of the United States, of cargo not taken on board at a port in the coastwise trade and discharged at another port in such trade. If such transportation is in a vessel chartered by the owner of any part of the cargo from a person not affiliated with such owner within the meaning of subdivision (b), the amount of freight money paid by the charterer for the transportation of such part of the cargo shall, for the purposes of this section, be such amount as is determined by the United States Shipping Board and certified by it to the Commissioner. In such cases the credit shall not be originally claimed by the taxpayer in his return, unless the return is accompanied by a copy of the certificate of the Shipping Board.

"(b) The credit provided in this section shall not be allowed with reference to transactions between persons who are affiliated. For the purposes of this section two or more corporations or associations shall be held to be affiliated if one corporation or association owns directly, or controls through closely affiliated interests or by a nominee or nominees, more than 50 per centum of the outstanding stock of or interest in the other; or if more than 50 per centum of the outstanding stock of or interest in such corporations or associations is owned directly, or controlled through closely affiliated interests or by a nominee or nominees, by the same interests. For the purposes of this section an individual or partnership shall be held to be affiliated with a corporation or association if more than 50 per centum of the outstanding stock of or interest in the corporation or association is owned directly, or controlled through closely affiliated interests or by a nominee or nominees, by the individual or partnership."

Government Compensation to Vessels as Income

Sec. 205. Subdivision (b) of section 213 of the Revenue Act of 1921 is amended by striking out the period at the end of paragraph (13) thereof, and inserting in lieu thereof a semicolon, and by adding after paragraph (13) a new paragraph to read as follows:

"(14) Amounts received by the owner of a vessel under section 403 of the Merchant Marine Act, 1922, out of the merchant marine fund created by such Act."

Tonnage Duties

Sec. 206. After 30 days from the enactment of this Act all amounts required to be levied, collected, and paid as tonnage duties, tonnage taxes, or light money, except such amounts as are required to be paid into the Treasury of the Philippine Islands, shall be double the amounts which would be required to be levied, collected, and paid if this Act had not been enacted. This section shall not apply in the case of a sailing vessel (as defined in section 405) of less than 1,000 gross tons, or in the case of any other kind of vessel of less than 1,500 gross tons.

TITLE III—TRANSPORTATION OF IMMIGRANTS BY WATER

Sec. 301. As nearly as practicable one-half of the total number of immigrants, admitted to the United States in any fiscal year, shall be transported in vessels registered, or enrolled and licensed, under the laws of the United States.

Sec. 302. The Commissioner General of Immigration with the approval of the Secretary of Labor shall make regulations necessary for the enforcement of section 301. All such regulations, in so far as they relate to the administration of such section by diplomatic or consular officers of the United States, shall be subject to the approval of the Secretary of State.

Sec. 303. Section 301 shall not take effect as to immigrants transported in a vessel documented under the laws of any foreign country until a time fixed by proclamation of the President. The President is authorized and directed, whenever in his opinion the provisions of this title or of regulations made thereunder, are or may be in conflict with treaties or conventions with a foreign country, to take such steps as may, in his opinion, be necessary to remove such conflict. Whenever, in his opinion, no such conflict exists in the case of any country he shall so proclaim, and the provisions of this title and regulations made thereunder shall take effect in the case of immigrants transported in vessels documented under the laws of such country at the time specified in his proclamation therefor.

Sec. 304. The term "United States" as used in this title in a geographical sense means the several States, the Territories of Alaska and Hawaii, the District of Columbia, Porto Rico, and the Virgin Islands.

TITLE IV—COMPENSATION TO VESSELS OF THE UNITED STATES

Definitions

Sec. 401. When used hereinafter in this Act—

(a) The term "person" means individual, partnership, corporation, or association;

(b) The term "United States," when used in a geographical sense, means the several States and the District of Columbia;

(c) The term "citizen of the United States" has the meaning assigned to it by section 2 of the Shipping Act, 1916, as amended by the Merchant Marine Act, 1920; and

(d) The term "board" means the United States Shipping Board.

Merchant Marine Fund

Sec. 402. There is hereby established in the Treasury a fund to be known as the "Merchant Marine Fund" (hereinafter in this title called the "fund"). The Secretary of the Treasury is authorized and directed to set aside in or credit to such fund, upon receipt, the following sums paid into the Treasury after the enactment of this Act:

(a) All tonnage duties, tonnage taxes, or light money, paid under law in force at the time of the enactment of this Act and under section 206 of this Act;

(b) 10 per centum of the amount of all customs duties paid under law in force at the time of the enactment of this Act or subsequently enacted;

(c) The amount which, except for the fact that the owner of the vessel has in force a contract with the board for compensation in respect to such vessel in accordance with the provisions of this title, would be payable, under law or any contract actually made thereunder, for the transportation of mails of any kind, except parcel post, by such vessel. Such amount shall be certified to the Secretary of the Treasury by the Postmaster General at least monthly; and

(d) All excess earnings paid by the owner of any vessel under the provisions of section 417.

Contract For Compensation

Sec. 403. (a) In order to aid the development and maintenance of the American Merchant Marine, to promote the growth of the foreign commerce of the United States, to contribute to the national defense and to carry out the policy set forth in section 1 of the Merchant Marine Act, 1920, the board is authorized and directed on behalf of the United States to enter into a contract with any person, a citizen of the United States who is the owner of a vessel, for the payment of compensation in respect to such vessel, subject to the limitations of this title. The board shall not be required to enter into such contract unless in the judgment of the board such person possesses such ability, experience, resources and character as, in the opinion of the board, to justify a belief that the payment of the compensation will be reasonably calculated to carry out such policies and otherwise promote the general welfare of the United States. The board shall not refuse to enter into any such contract on the ground that such person is not so qualified unless such refusal is specifically authorized by an affirmative vote of not less than five members of the board, and unless the vote and a full statement of the reasons for the refusal are spread upon the minutes of the board.

(b) Such contract shall provide that it shall be made for a period not exceeding ten years from the date thereof, and shall provide that the payments of the compensation shall be made at reasonable intervals not exceeding six months.

(c) The Secretary of the Treasury is authorized and directed to pay, out of any moneys in the fund, compensation to the owner of any vessel with whom there has been made a contract under this section; but such payment shall be made only upon vouchers signed by the chairman of the board, under authorization of the board. All moneys in the fund are hereby permanently appropriated for the purpose of making such payments and the refunds authorized by subdivision (j) of section 417.

Amount of Compensation

Sec. 404. Compensation shall be computed as follows: For each gross ton of the vessel for each 100 nautical miles covered by the vessel, there shall be paid—

(a) Regardless of the speed of which the vessel is capable,—one-half of one cent; and

(b) In case of a power-driven vessel capable of making (when self-propelled solely by machinery) a speed of 12 knots or over when on such draft as the owner may select, and in addition to any amount payable to such vessel under subdivision (a),—

(1) One-tenth of one cent,—if such speed is 12 knots or over but less than 13 knots;

(2) Two-tenths of one cent,—if such speed is 13 knots or over but less than 14 knots;

(3) Three-tenths of one cent,—if such speed is 14 knots or over but less than 15 knots;

(4) Four-tenths of one cent,—if such speed is 15 knots or over but less than 16 knots;

(5) Five-tenths of one cent,—if such speed is 16 knots or over but less than 17 knots;

(6) Seven-tenths of one cent,—if such speed is 17 knots or over but less than 18 knots;

(7) Nine-tenths of one cent,—if such speed is 18 knots or over but less than 19 knots;

(8) One and one-tenth cents,—if such speed is 19 knots or over but less than 20 knots;

(9) One and three-tenths cents,—if such speed is 20 knots or over but less than 21 knots;

(10) One and five-tenths cents,—if such speed is 21 knots or over but less than 22 knots;

(11) One and eight-tenths cents,—if such speed is 22 knots or over but less than 23 knots; and

(12) Two and one-tenth cents,—if such speed is 23 knots or over.

SEC. 405. For the purpose of computing compensation under this title—

(a) A vessel shall be held to be power-driven if it is equipped so as to be self-propelled through the use of machinery, and if the rated horsepower of the propulsive machinery exceeds one-third the gross tonnage of the vessel;

(b) A vessel shall be held to be a sailing vessel if it is equipped so as to be self-propelled through the use of sails, and is not equipped so as to be self-propelled through the use of machinery;

(c) The gross tonnage of a vessel shall be as determined under the laws of the United States and stated upon the vessel's certificate of admeasurement;

(d) The speed which a vessel is capable of making on such draft as the owner may select, shall be ascertained by the board at such reasonable intervals and by such methods as the board may by regulation prescribe;

(e) The mileage covered by the vessel shall be determined solely by the distances of the direct, customary route, for vessels of the same type and kind upon similar voyages, between the ports touched by the vessel, based upon tables of such distances approved by the board; except that if such distances do not, in the opinion of the board, fairly represent the distances which, under efficient operation, are required actually to be traversed by the vessel upon its voyage, the board may increase the mileage to such an extent as it deems fair and reasonable; but in no case shall the mileage as so increased be in excess of the mileage actually traversed by the vessel;

(e) In computing mileage a fractional part of 100 miles shall be disregarded unless in excess of 50 miles, in which case it shall be counted as 100 miles;

(f) Any power-driven vessel of 5,000 gross tons or less but of 1,500 gross tons or over, shall be considered as if it were a vessel of 5,000 gross tons.

When Vessels Not Entitled to Compensation

SEC. 406. (a) Compensation shall not be paid in respect to any sailing vessel whose tonnage is less than 1,000 gross tons, and shall not be paid in respect to any other kind of vessel whose tonnage is less than 1,500 gross tons.

(b) Compensation shall be paid in respect to any vessel only for mileage covered while the vessel—

(1) Is a privately owned merchant vessel; and

(2) Is registered, or enrolled and licensed, under the laws of the United States; and

(3) Is self-propelled by sails or machinery except when in distress or being aided by means of tugs or other assistance on entering or leaving port or in navigating any inland or restricted waterway; and

(4) Is classed by the American Bureau of Shipping in the highest classification open to vessels of its type and kind according to the rules of the bureau; and

(5) Carries a crew (exclusive of licensed officers required by law) at least two-thirds of which are citizens of the United States, and the remainder of which are individuals eligible to United States citizenship. During the first year after the enactment of this Act the required number of citizens of the United States shall be one-half instead of two-thirds; and, during the second year, six-tenths instead of two-thirds. In the case of passenger vessels the provisions of this paragraph shall apply only to the deck and engine departments. If the vessel is deprived of the services of any member of the crew by desertion, casualty, or other cause beyond the control of the master, in any port outside the United States or on the high seas, the right of the vessel's owner to compensation, during the period prior to the next arrival of the vessel at a port in the United States, shall not be impaired by failure to comply with the provisions of this paragraph, provided the owner and the master of the vessel exercise reasonable diligence to procure the necessary individuals to comply with such provisions. If the vessel is outside the United States at the time of the enactment of this Act, or on the first day of the second or third year after the enactment of this Act, the owner shall not be required to comply with the provisions of this paragraph applicable to such year until her first arrival at a port in the United States, if he complies with the provisions of this paragraph applicable to the previous year.

(c) Compensation shall not be paid in respect to any vessel unless the vessel—

(1) Is registered, enrolled, or licensed, under the laws of the United States on the sixtieth day after the enactment of this Act; or

(2) Is built in the United States, its Territories or possessions, or the Canal Zone, after the enactment of this Act; or

(3) Is, at the time of the enactment of this Act, undocumented and owned by a person, a citizen of the United States, and is not thereafter documented under the laws of any foreign country; or

(4) Is owned by the United States at the time of the enactment of this Act and is not thereafter documented under the laws of any foreign country, or

(5) Was built in a foreign country before the enactment of this Act, and is, within three years after the enactment of this Act, registered under the laws of the United States; except that compensation shall be paid in respect to any such foreign-built vessel only if such vessel is, upon the affirmative vote of at least five of the members of the board, specifically authorized to receive compensation and specifically certified to be essential to the proper development of the merchant marine of the United States by reason of the particular type or kind of vessel, and if such vote and a full statement of the reasons for such authorization and certification are spread upon the minutes of the board.

Foreign Trade

SEC. 407. (a) Except as provided in subdivision (b), (d), or (e), a vessel shall for the purposes of this title, be held to be engaging in foreign trade while operated on any voyage as a merchant vessel.

(b) A vessel shall not, for the purpose of this title, be held to be engaged in foreign trade while carrying any passengers or cargo—

(1) Which are taken on board at a port in the United States and discharged at a port in the United States;

(2) Which are taken on board at a port in the United States and discharged at a port in Alaska or Porto Rico;

(3) Which are taken on board at a port in Alaska or Porto Rico and discharged at a port in the United States;

(4) Which are taken on board at a port in the United States and discharged at a port in Hawaii, if the revenue accruing to the vessel by reason of the carriage of such passengers and cargo amounts to more than one-fourth the total revenue accruing to the vessel by reason of the carriage from point of origin to point of distination of passengers and cargo on board at the time of departure from the last port of call in the United States;

(5) Which are taken on board at a port in Hawaii and discharged at a port in the United States, if the revenue accruing to the vessel by reason of the carriage of such passengers and cargo amounts to more than one-fourth the total revenue accruing to the vessel by reason of the carriage from point of origin to point of distination of the passengers and cargo on board at the time of departure from the last port of call in Hawaii; or

(6) Which are taken on board at a port in Alaska, Hawaii, Porto Rico, the Virgin Islands, the Philippine Islands, or the Canal Zone, and discharged at a port in the same Territory, possession, or Zone.

(c) Subdivision (b) shall not apply (1) to a voyage for the carriage of passengers on a special or sight-seeing tour, or for scientific purposes, if the vessel does not in the judgment of the board carry passengers or cargo in competition with vessels in the coastwise trade; nor (2) to merchant vessels while operating as auxiliaries to the military or naval forces of the United States.

(d) A vessel shall not, for the purposes of this title, be held to be engaged in foreign trade while moving without passengers or cargo—

(1) Between ports in the United States, unless the next carriage of passengers or cargo is to or from a port outside the United States, Alaska, Hawaii, and Porto Rico;

(2) Between the United States and Alaska, Hawaii, or Porto Rico, unless the next carriage of passengers or cargo is to or from a port outside the United States and outside such Territory or possession:

(3) Between a port in Alaska, Hawaii, or Porto Rico and a port in the same Territory or possession, unless the next carriage of passengers or cargo is to or from a port outside such Territory or possession and outside the United States; or

(4) Between a port in the Virgin Islands, the Philippine Islands, or the Canal Zone, and a port in the same possession or Zone, unless the next carriage of passengers or cargo is to or from a port outside such possession or Zone.

(e) A vessel shall not, for the purpose of this title, be held to be engaged in foreign trade while operating on the Great Lakes or adjacent or connecting waterways, unless the voyage begins or ends east of Quebec, Canada.

SEC. 408. (a) Compensation shall be paid in respect to any vessel only for mileage covered while the vessel is engaged in foreign trade upon a voyage of which one of the ports is a port of the United States, its Territories or possessions, or the Canal Zone; except that any vessel engaged in foreign trade shall be paid compensation for mileage covered in such trade during any period of time (1) if the vessel has entered or cleared from a port of the United States at any time during the 12 months prior to such period of time and after the making of the contract; or (2) if the vessel during the six months ending with such period of time has derived at least one-half of the total revenue accruing to it by reason of the carriage of passengers and cargo, from passengers and cargo received from or delivered to vessels which are registered, or enrolled and licensed, under the laws of the United States and whose voyage began or terminated at a port in the United States, its Territories or possessions, or the Canal Zone.

(b) Compensation shall not be paid in respect to any vessel for mileage covered upon a voyage in foreign trade during which the vessel enters or clears from a port in the United States, its Territories or possessions, or the Canal Zone, if the distance between the terminal ports of the voyage is less than 150 nautical miles.

Ownership of Vessels by Citizens of the United States

SEC. 409. (a) Compensation shall be paid in respect to any vessel only for mileage covered while the vessel is owned by a person, a citizen of the United States.

(b) Compensation earned after three years from the enactment of this Act shall not be paid to any vessel owner unless, at all times during the period over which such compensation was earned, at least 75 per centum of (1) the total gross tonnage of all vessels (other than those documented for the coastwise trade only and other than those operating on the Great Lakes or adjacent or connecting waterways upon voyages neither beginning nor terminating east of Quebec, Canada), which are owned or chartered by such vessel owner, or for which such owner acts as agent, plus (2) the total gross tonnage of all such vessels owned or chartered by any person affiliated with such vessel owner, or for which such affiliated person acts as agent, is comprised of vessels registered under the laws of the United States.

(c) For the purpose of subdivision (b)—

(1) Two or more corporations or associations shall be held to be affiliated if one corporation or association owns directly, or controls through closely affiliated interests or by a nominee or nominees, 50 per centum or more of the outstanding voting stock or voting power of the other, and owns directly, or through closely affiliated interests or by a nominee or nominees, 80 per centum or more of all the outstanding stock of or interest in the other; or if 50 per centum or more of the outstanding voting stock or voting power of two or more corporations or associations is owned directly, or controlled through closely affiliated interests, or by a nominee or nominees, by the same interests, and 80 per centum or more of all the outstanding stock of or interest in such corporations or associations is owned directly, or through closely affiliated interests or by a nominee or nominees, by the same interests;

(2) An individual or partnership shall be held to be affiliated with a corporation or association if 50 per centum or more of the outstanding voting stock or voting power of such corporation or association is owned directly, or controlled through closely affiliated interests or by a nominee or nominees, by the individual or partnership, and 80 per centum or more of all the outstanding stock of or interest in the corporation or association is owned directly, or through closely affiliated interests or by a nominee or nominees, by the individual or partnership.

(d) The board may suspend from time to time the provisions of subdivision (b) in respect to a power-driven vessel of a particular type or kind, which any person desires to own or charter, if, in the opinion of the board, vessels of such type or kind registered, or enrolled and licensed, under the laws of the United States are not reasonably available for the purposes desired. Any vessel in respect to which such suspension is made, shall not be counted in computing gross tonnage for the purposes of subdivision (b).

INCREASE AND DECREASE OF COMPENSATION

SEC. 410. (a) Whenever the board determines that in order to promote the welfare of the United States, the operation of vessels in any particular service, or of any particular type and kind, is desirable and necessary, and that the rate of compensation authorized under section 404 is insufficient to induce the operation of vessels in such service, or of such type and kind, the board in making the contract for compensation may provide therein for the increase of the rate of compensation authorized in respect to such vessel under said section, to such an extent as it deems necessary to procure the establishment and maintenance of such service and the operation of vessels in such service, or the operation of vessels of such type and kind; but the rate of compensation as so increased shall not exceed twice the rate authorized by said section. As used in this subdivision and in section 411 the term "service" includes the route on which the vessel operates, the frequency of sailings, and the speed which she maintains.

(b) Whenever the board determines that the rate of compensation authorized under section 404 is excessive under the special circumstances of any particular case, it shall, in making the contract for compensation, provide therein for the decrease of the rate of compensation to such an extent as it deems advisable.

(c) After the making of the contract of compensation the board may, with the consent of the other party thereto, decrease or, within the limit provided by subdivision (a), increase, the rate of compensation to be paid.

(d) No increase or decrease shall be made under the provisions of this section unless such increase or decrease is specifically authorized by the board upon the affirmative vote of not less than five members, and unless such vote and a full statement of the reasons for the increase or decrease are spread upon the minutes of the board.

MAINTENANCE OF SERVICE OR ROUTE

SEC. 411. (a) The contract for compensation in respect to any vessel may provide that the vessel shall be operated in a particular service (1) if the rate of compensation is based thereon, and (2) if the contract also provides a different rate of compensation to be paid in respect to any period of time after the obligation of the owner to operate the vessel in such service has been terminated as provided in subdivision (b).

(b) If the contract provides for the operation of the vessel in a particular service the obligation of the owner to so operate the vessel may be terminated upon six months' written notice to the board. Upon the failure of the owner to operate the vessel in such service (act of God and restraint of princes excepted) before his obligation has terminated, then, (1) all rights to compensation earned since the last time for payment provided in the contract may, at the option of the board, be forfeited, and (2) the board may terminate the entire contract.

REQUISITION OF COMPENSATED VESSELS

SEC. 412. Any vessel in respect to which a contract for compensation is made, may, at any time during the period for which the contract is made, be taken and purchased or used by the United States for national defense or during any national emergency declared by proclamation of the President. In such event the owner shall be paid the fair actual value of the vessel at the time of taking, or paid fair compensation for her use based upon such fair actual value; but in neither case shall such fair actual value be enhanced by the causes necessitating the taking. In the case of a vessel taken and used, but not purchased, the vessel shall be restored to the owner in a condition at least as good as when taken, less reasonable wear and tear, or the owner shall be paid an amount for reconditioning sufficient to place the vessel in such condition. The owner shall not be paid for any consequential damages arising from such taking and purchase or use. If there is a disagreement between the United States and the owner of the vessel as to the fair actual value, fair compensation, or amount for reconditioning, such value, compensation, or amount shall be determined by arbitration, one of the arbitrators to be selected by the President, one by the owner of the vessel, and the third by the two thus selected, or, if they can not agree, by the Chief Justice of the United States.

REPAIRS, RENEWALS, AND RECONDITIONING OF COMPENSATED VESSELS

SEC. 413. All repairs, renewals, or reconditioning of any vessel in respect to which a contract for compensation is made, or of the machinery or equipment of the vessel, shall be done in a port in the United States, its Territories or possessions, or the Canal Zone; except that repairs or renewals may be made in a foreign port, if the repairs or renewals are essential to the safety of the vessel, its passengers, crew, or cargo, or are made to a vessel operating exclusively between foreign ports and entitled to compensation solely by reason of the provisions of clause (2) of subdivision (a) of section 408. The board shall refuse to pay any person who fails to perform his obligations under this section, such amount of compensation as the board may determine.

CARRIAGE OF MAILS BY COMPENSATED VESSELS

SEC. 414. (a) A vessel in respect to which a contract for compensation is made, shall, whether or not such vessel is built in the United States, transport free for the whole or any part of any voyage which the vessel actually makes or is required under the contract to make, mail matter of any kind, except parcel post, in such amounts as the Postmaster General may require. Such transportation shall be subject to the provisions of law and regulations made thereunder (including the imposition by the Postmaster General of fines and penalties for delays and irregularities in the performance of service) pertaining to the conveyance of the mails.

(b) The rights of any person under law or any contract made thereunder, for compensation in respect to any vessel for the transportation by such vessel of mails of any kind, except parcel post, shall be terminated if such person has made a contract for compensation under this title in respect to such vessel. Nothing in this title shall be held to relieve such person from the performance of his obligations under such law or contract.

SALE OF COMPENSATED VESSELS

SEC. 415. If a vessel in respect to which a contract for compensation is made, is sold prior to the expiration of the contract, the compensation shall cease, unless a new contract therefor is made by the board with the purchaser.

SEC. 416. If a contract for compensation has been made with respect to a vessel, any person who purchases such vessel before the expiration of the term for which the contract was made shall be held to take the vessel with notice of, and subject to, the right of the United States to take and purchase or use such vessel as provided in section 412.

REPAYMENT OF COMPENSATION

SEC. 417. (a) When used in this section, the terms "taxable year," "gross income," "net income," and "invested capital" shall have the same meaning as when used in the Revenue Act of 1921.

(b) The owner of a vessel or vessels who has made a contract with the board for compensation in respect thereto shall pay to the United States 50 per centum of the amount by which his net income for the taxable year, attributable to the operations of such vessels, exceeds 10 per centum of his invested capital for such year attributable to such vessels; but in no case shall the amount so to be paid exceed the amount of compensation earned in respect to such vessels during the taxable year under a contract made under this title by the owner.

(c) In computing the gross income attributable to the operations of the vessels there shall be included the amount of compensation earned under this title in respect to the vessels during the taxable year. In computing the net income attributable to the operations of the vessels there shall be deducted from gross income a reasonable amount, determined by the board and certified by it to the Commissioner of Internal Revenue, as representing the fair value of the products, services, or facilities furnished by the owner of the vessels in connection with the operations of the vessels. There shall not be allowed as a deduction in computing the net income attributable to the operations of the vessels the deduction provided in section 265 of the Revenue Act of 1921 as amended by this Act.

(d) If the owner of the vessels uses them in whole or in part for the transportation of his own property, his gross income attributable to the operations of the vessels in transporting such property shall be considered to be such amount as is determined by the board, and certified by it to the Commissioner of Internal Revenue, as representing the fair value of the services performed by the vessels in transporting such property.

(e) If the owner of the vessels is an individual, a partnership, or an estate or trust, the invested capital shall be determined under rules and regulations prescribed by the Commissioner of Internal Revenue with the approval of the Secretary of the Treasury, so as to equal, as nearly as may be practicable, the invested capital that would be allowable to such owner if a corporation.

(f) For the purpose of making an accurate distribution or apportionment of profits, income, deductions, or invested capital, in computing net income and invested capital for the taxable year, among two or more trades or businesses (whether incorporated or unincorporated, or whether or not organized or created in the United States) controlled directly or indirectly by the same interests, the Commissioner of Internal Revenue may consolidate the accounts of such trades or businesses in any of the following cases:

(1) If the person conducting one of such trades or businesses in dealing with the person conducting another, bought from or sold to the other person during the taxable year products, services or facilities at prices above or below the current market price, thus effecting an artificial distribution of profits;

(2) If one such person in any way so arranged his financial relations with another such person during the taxable year as to assign to either a disproportionate share of net income or invested capital; or

(3) Where for any reason it appears to the Commissioner of Internal Revenue that the net income or invested capital attributable to the vessels as shown by the return of the owner does not fairly reflect the actual or true net income or invested capital of the owner.

(g) Every person liable for the payment provided for in subdivision (b) shall make, at the time and in the manner provided by law for making his income-tax return, a return, in such form as may be prescribed by the Commissioner of Internal Revenue, stating his net income attributable to the operations of the vessels, his invested capital attributable to the vessels, and any other information relating to the determination of the amount payable under this section, which may be required by the Commissioner. A copy of such return, together with all schedules and data submitted therewith, shall be transmitted to the board at the same time that the return is filed.

(h) The entire amount for which the owner of the vessels is liable under this section shall be due and payable at the same time and in the same manner, and shall be collected in the same manner, as the first installment of income tax imposed by law.

(i) For the purposes of this section the amount of compensation earned in respect to the vessels during the taxable year shall be determined by the board and certified by it to the Commissioner of Internal Revenue.

(j) Amounts paid under this section shall be covered into the Treasury to the credit of the Merchant Marine Fund created by section 402. Any refunds due on account of overpayment shall be paid out of such fund on vouchers approved by the Commissioner of Internal Revenue and countersigned by the chairman of the board.

(k) The provisions of Titles I, II, III, and XIII of the Revenue Act of 1921, including penal and other provisions relating to the assessment, collection, remission, or refunding of income and excess-profits taxes imposed by Act of Congress, and the provisions of any other internal-revenue law of the United States relating to the assessment, collection, remission, or refunding of such taxes, shall, so far as practicable, extend and be applicable to the determination, collection, remission, or refunding of the payments provided for in this section.

(l) The Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall make rules and regulations for the enforcement of the provisions of this section, and shall have charge of the administration of this section.

OBLIGATION OF VESSEL OWNER UNDER CONTRACT FOR COMPENSATION

SEC. 418. (a) The board shall provide in every contract for compensation with any person, that such person agrees to accept and comply with the provisions of sections 412, 413, 414, 415, and 417. Whether or not the contract does so provide, such person shall be held to have so agreed.

(b) Any contract for compensation with any person may be canceled by him at any time without the consent of the board; but the cancellation shall not relieve him of his obligations under sections 412 and 417, or of any obligation into which he may have entered, pursuant to the provisions of section 411, to operate the vessel in a particular service.

(c) The board shall provide in the contract no terms or conditions except those which are (1) specified in subdivision (a) or in section 411, or (2) necessary to carry out the provisions of sections 411, 412, 413, 414, 415, and 417, or (3) necessary to the ascertainment and determination of the amount of compensation, at the rate fixed in the contract, which under the provisions of this title is properly payable.

FINAL DETERMINATION OF AMOUNT OF COMPENSATION

SEC. 419. The determination of the board as to the amount of compensation to which any person is entitled under the provisions of this title, shall not be subject to review by the General Accounting Office.

TITLE V—ARMY AND NAVY TRANSPORTS

SEC. 501. Whenever in the judgment of the President adequate transportation facilities to meet any or all of the needs of the Army, Navy, or Marine Corps are afforded by vessels registered, or enrolled and licensed, under the laws of the United States, he may direct the discontinuance in whole or in part of the transport service of either the Army or the Navy and transfer to the board or place out of commission any of the vessels now or hereafter engaged in either of such services. Whenever such dis-

position is made the Secretary of War and the Secretary of the Navy respectively are authorized and directed to enter into contracts with owners of vessels registered, or enrolled and licensed, under the laws of the United States, for such transportation as may be required by the Army, the Navy, or the Marine Corps, respectively. Such contracts may be for a term of ten years. The board shall furnish whatever assistance may be necessary in the making of such contracts. There is hereby authorized to be appropriated such sums as are necessary to meet the payments required under such contracts.

TITLE VI—PROVISIONS RELATING TO RAIL AND WATER TRANSPORTATION

DEFINITIONS

SEC. 601. As used in this title the term "commission" means the Interstate Commerce Commission.

INTERRELATIONS OF RAIL AND WATER TRAFFIC

SEC. 602. (a) It is hereby declared to be the policy of Congress to promote, encourage, and develop water transportation, service, and facilities in connection with the commerce of the United States, and to foster and preserve in full vigor both rail and water transportation, and the board and the commission are hereby severally authorized, empowered, and directed to co-operate to that end.

(b) The board and the commission are authorized and directed to create a joint board, selected from among their members, officers, and employees, to study the conditions and interrelations of rail and water traffic, and the principles and methods essential to accomplishing the policy declared in subdivision (a).

(c) The joint board shall appoint a secretary who shall keep minutes of its meetings, which minutes shall be furnished to the members of the board and of the commission. The joint board shall hold regular semi-monthly and such additional meetings as may be necessary to transact properly its business.

(d) The joint board shall formulate and make such recommendations to the board and the commission, not inconsistent with law, pertaining to the interrelations of rail and water traffic, as it deems necessary to accomplish the policy declared in subdivision (a). The board shall make effective, by such means as are granted it by law, any such recommendation upon any matter within its jurisdiction, if such recommendation is approved by the board. The commission shall have a like duty as to any such recommendation upon any matter within its jurisdiction.

(e) None of the provisions of this section shall be construed to affect the power or jurisdiction of the commission, or to confer upon the board concurrent power or jurisdiction over any matter within the power or jurisdiction of the commission.

EXPORT BILLS OF LADING

SEC. 603. Paragraph (4) of section 25 of the Interstate Commerce Act, as amended, is amended by adding at the end thereof a new sentence to read as follows: "In making rules and regulations prescribing the form of such through bills of lading, the commission shall adopt as the portion thereof governing the carriage of goods by water in foreign commerce such form as may be certified to the commission by the United States Shipping Board for such purpose."

RAIL-OWNED WATER LINES

SEC. 604. Paragraph (9) of section 5 of the Interstate Commerce Act, as amended, is amended by striking out the period at the end thereof and inserting in lieu thereof a colon and the following: "*Provided,* That the foregoing provisions of this paragraph shall not apply in any case where such common carrier by water or such vessel is engaged exclusively (a) in trade (other than with foreign contiguous territory) not included in the coastwise trade, or (b) in trade between ports in the United States and ports in the Philippine Islands."

AGREEMENTS BETWEEN CARRIERS AFFECTING WATER TRANSPORTATION

SEC. 605. Section 15 of the Shipping Act, 1916, is amended to read as follows:

"SEC. 15. (a) That every common carrier by water, or other person subject to this Act, shall file immediately with the board a true copy, or, if oral, a true and complete memorandum, of every agreement with another such carrier or other person subject to this Act, or modification or cancellation thereof, to which it may be a party or conform in whole or in part, fixing or regulating transportation rates or fares; giving or receiving special rates, accommodations, or other special privileges or advantages; controlling, regulating, preventing, or destroying competition; pooling or apportioning earnings, losses, or traffic; allotting ports or restricting or otherwise regulating the number and character of sailings between ports; limiting or regulating in any way the volume or character of freight or passenger traffic to be carried; providing warehousing, docking, or other terminal facilities; providing that the one carrier shall act in any manner as agent or representative of the other carrier; or in any manner providing for an exclusive, preferential, or co-operating working arrangement.

"(b) Every common carrier by water shall file immediately with the board a true copy, or, if oral, a true and complete memorandum, of every agreement with a common carrier by railroad subject to the provisions of the Interstate Commerce Act, as amended, or modification or cancellation thereof, to which it may be a party or conform in whole or in part, relating to the interchange of freight or passengers, or the making of joint or through rates, or providing warehousing, docking, or other terminal facilities, or providing that the one carrier shall act in any manner as agent or representative of the other carrier, or in any manner providing for a co-operative working arrangement between the two carriers. In all such cases the common carrier by railroad shall also have a like duty. The provisions of this subdivision shall apply only to agreements relating to passengers or property transported or to be transported to or from a foreign country or the Philippine Islands from or to a port or other place in the United States.

"(c) The term 'agreement' as used in this section includes understandings, conferences, and other arrangements.

"(d) The board may by order disapprove, cancel, or modify any agreement, or any modification or cancellation thereof, whether or not previously approved by it, that it finds to be unjustly discriminatory or unfair as between carriers, shippers, exporters, importers, or ports, or between exporters from the United States and their foreign competitors, or to operate to the detriment of the commerce of the United States, or to be in violation of law or to be otherwise detrimental to the interests and welfare of the United States, and shall approve all other agreements, modifications or cancellations.

"(e) Agreements existing at the time of the enactment of the Merchant Marine Act, 1922, shall be lawful until disapproved by the board. It shall be unlawful to carry out any agreement or any portion thereof, disapproved by the board.

"(f) All agreements, modifications, or cancellations, made after the enactment of the Merchant Marine Act, 1922, shall be lawful only when and as long as approved by the board, and before approval or after disapproval it shall be unlawful to carry out in whole or in part, directly or indirectly, any such agreement, modification, or cancellation.

"(g) Every agreement, modification, or cancellation, lawful under this section, shall be excepted from the provisions of the Act entitled 'An Act to protect trade and commerce against unlawful restraints and monopolies,' approved July 2, 1890, and amendments thereof and Acts supplementary thereto, and the provisions of sections 73 to 77, both inclusive, of the Act entitled 'An Act to reduce taxation, to provide revenue for the Government, and for other purposes,' approved August 27, 1894, and amendments thereof and Acts supplementary thereto.

"(h) Whoever violates any provision of this section shall be liable to a penalty of $1,000 for each day such violation continues, to be recovered by the United States in a civil action."

SEC. 606. Paragraph (d) of paragraph (13) of section 6 of the Interstate Commerce Act, as amended, is amended to read as follows:

"(d) If any carrier by railroad subject to this Act enters into arrangements lawful under section 15 of the Shipping Act, 1916, as amended, with any carrier by water operating from a port in the United States to a foreign country, for the handling of through business between interior points of the United States and such foreign country, the commission may require such carrier by railroad to enter into similar arrangements with any or all other carriers by water operating from such port to the same foreign country, but such arrangements shall be subject to the provisions of section 15 of the Shipping Act, 1916, as amended."

JOINT OR PROPORTIONAL RATES

SEC. 607. Section 28 of the Merchant Marine Act, 1920, is amended to read as follows:

"SEC. 28. (a) That no common carrier shall charge, collect, or receive, for transportation subject to the Interstate Commerce Act, as amended, of passengers or property, under any joint rate, fare, or charge, or under any export, import, or other proportional rate, fare, or charge, which is based in whole or in part on the fact that the passengers or property affected thereby are to be transported to, or have been transported from, any port in a possession or dependency of the United States, or in a foreign country, by a carrier by water in foreign commerce, any lower rate, fare, or charge than that charged, collected, or received by it for the transportation of passengers, or of a like kind of property, for the same distance, in the same direction, and over the same route, in connection with commerce wholly within the United States, unless the vessel so transporting such passengers or property is, or unless it was at the time of such transportation by water, documented under the laws of the United States.

"(b) Whenever the board is of the opinion, however, that adequate shipping facilities to or from any port in a possession or dependency of the United States or a foreign country are not afforded by vessels so documented, it shall certify this fact to the Interstate Commerce Commission, and the commission shall, by order, suspend temporarily the operation of the provisions of this section with respect to the rates, fares, and charges for the transportation by rail of passengers and property transported from, or to be transported to, such ports.

"(c) Such suspension of operation of the provisions of this section shall be terminated upon 30 days' notice, given in accordance with the requirements of section 6 of the Interstate Commerce Act, as amended, by order of the commission whenever the board is of the opinion that adequate shipping facilities by such vessels to or from such ports are afforded and so certifies to the commission.

"(d) Whenever the board and the commission are both of opinion, and certify, that putting into effect or keeping in effect the provisions of this section will result in unjust discrimination between ports of the United States on commerce accustomed to move through such ports or in materially changing the channels of transportation within the United States, or in unduly congesting one or more of the ports of the United States, the commission shall, by order, suspend the operation of said provisions until such time as it and the board reach a contrary conclusion in the premises, whereupon such suspension shall, by order, be terminated by the commission upon 30 days' notice as hereinbefore provided for the termination of other suspensions."

TITLE VII—MISCELLANEOUS PROVISIONS

TRANSPORTATION BY WATER OF GOVERNMENT OFFICIALS

SEC. 701. Any officer, employee, or agent of the United States, including legislative, judicial, diplomatic, and consular officers, and officers serving in the military or naval forces of the United States, travelling by water, when the expense of such passage is chargeable directly or indirectly to the United States, shall, when practicable travel in a public vessel of the United States or a vessel registered, or enrolled and licensed, under the laws of the United States. When passage in such a vessel is not practicable, the voyage may be made in a vessel under a foreign flag only when specifically ordered by the head of the department or other Government establishment concerned or upon order specifically approved by such head of department or other Government establishment, who shall as promptly as possible report each such voyage made in a vessel under a foreign flag, together with the reasons showing necessity therefor, to the board.

(b) Any person subject to the provisions of subdivision (a) who fails to comply therewith in respect to the passage taken shall not be reimbursed for such passage money, or shall be surcharged in his accounts with the United States with the amount thereof, as the case may require.

TRANSPORTATION OF GOVERNMENT SUPPLIES

SEC. 702. All goods, wares, merchandise and material of every nature (including supplies for the military or naval forces of the United States) belonging to or intended for the United States, transported by water, shall when practicable be shipped in a public vessel of the United States or a vessel registered, or enrolled and licensed, under the laws of the United States. When shipment in such a vessel is not practicable and the shipment is made in a vessel under a foreign flag, it shall be the duty of the officer, employee or agent of the United States authorizing or making the shipment, within one month thereafter, to mail a written notice to the board, stating the ports of departure and destination, the date, the name of the vessel, and the reason why the shipment was not made in a public vessel or a vessel registered, or enrolled and licensed, under the laws of the United States.

REGULATIONS

SEC. 703. Except where otherwise specifically provided in this Act, the board may make such regulations in respect to matters placed under its jurisdiction by this Act as it deems necessary in order to make effective the intent and purposes of this Act.

SEPARABILITY

SEC. 704. If any provision of this Act or the application thereof to any person or circumstance is held invalid the validity of the remainder of the Act and of the application thereof to other persons and circumstances, shall not be affected thereby.

SHORT TITLE

SEC. 705. This Act may be cited as the "Merchant Marine Act, 1922."

Developments in Marine Insurance

Restrictive Clauses Troublesome—Hague Rules—More Board Vessels Rated—Rules for Inland Craft—Syndicates Praised

By "Bordereaux"

FROM the viewpoint of the underwriter there is a decided danger in the use of limiting clauses that restrict the liability of the carrier. Considerable interest has recently been taken in a clause used in connection with shipments of cotton and which has been inserted in ocean bills of lading by steamship companies operating out of New Orleans. It reads as follows:

"All risks of fire, flood, high water, rain, collapse of wharf, or any other causes not happening through the fault or negligence of the owner, master, or agent of the vessel occurring prior to actual loading aboard vessel, to be borne by the owner of the goods whether or not actually receipted for by vessel or agent."

Underwriters insist that carriers are unquestionably beyond their rights in making use of such a clause, as Section I of the Harter Act prohibits the use of clauses limiting the liability of the carriers with respect to the care and custody of cargoes and, if the damage to the cotton is in any way due to the fault of the carrier, even though the floods are partially responsible, the carriers should not be allowed to evade their liability by hiding behind such a restriction. It will readily be seen that the question of the negligence of the carrier could not be subsequently raised in court, if the shipper could be shown to have had knowledge of this clause and so to be bound by it.

Assureds, holding open policies on cotton, have been advised by their underwriters that this clause is not only a violation of the contract between carrier and shipper but that it is in violation of the policy clause which reads, "Warranted by the assured that they will not relieve any carrier or other bailee from any statutory or common law liability or duty." It is of prime importance for the shipper thoroughly to understand the seriousness of this contract obligation, for such a breach of warranty renders the policy voidable at the option of the underwriter.

Furthermore, there is no occasion for the carrier to employ such a clause for his own protection as he has a perfectly sound defense in event of a claim for flood damage; under the common law he cannot be held liable for damage by floods, as it is one of the so-called acts of God, nor is he made liable by statute—hence the suspicion of the underwriters that there was some ulterior purpose behind the introduction of the obnoxious clause.

The bailee clauses in marine insurance policies are broad in their provisions, but their intent has been to prevent the carrier from taking advantage of the shipper's insurance and thereby limiting the legal liability of the former. The trouble with some bailee clauses is that they are so restrictive that, if construed technically, the assured would have no coverage whatever. Most underwriters, however, follow a bailee clause with a saving clause wherein the underwriter agrees to pay the claim of the assured, if caused by an insured peril, provided the assured is able to collect the same from the carrier.

The Hague Rules

UNQUALIFIED endorsement of the Hague Rules, 1921, has made little progress in this country of late. They were let down by the National Foreign Trade Convention with the mildest kind of an acknowledgment and a suggestion of further study, while the United States Chamber of Commerce contented itself with a qualified endorsement of them as "a step in advance" and a request of Congress to enact legislation for the rules "with such interpretations as may be deemed necessary." Opponents of the rules insist that they are obscure and will have to be clarified before they can be endorsed; and, further, that care must be taken that international uniformity be not secured at the price of national interests. This point was carefully emphasized in the resolution adopted at the recent annual meeting of the National Association of Manufacturers, in New York, when the rules were approved as "a practical step forward," to which was added the significant qualification, "but not as a final substitute for highly desirable national legislation fortified by international agreements."

In his address before the Ninth National Foreign Trade Convention, President Benjamin Rush, of the Insurance Company of North America, observed:

"I am not in favor of the Hague Rules in their present form. They are defective in that they deal only with the responsibility of the shipowner while the goods are on board of his ship, and fail to deal with his responsibility while the goods are in his custody but not actually on the ship. They do not apply to deck cargoes . . . . When properly amended, as indicated above, they will be a step in advance over the conditions now prevailing, but they still fall far short of the full protection to which innocent cargo is entitled at the hands of the shipowner. They will, therefore, be in the nature of a compromise between conflicting interests and they should not therefore cause any cessation in the efforts made by merchants and shippers to reimpose upon carriers full responsibility for losses resulting by their negligence or the negligence of their servants."

More Board Vessels Rated

MARINE underwriters announce progress in their cooperative work in connection with the Shipping Board in the matter of readjusting steamer classifications for cargo rating purposes. All Board vessels of the twin-screw passenger type, not over 20 years old, are to be recommended for first class liner classifications. These proposals refer to vessels operated by four lines—the United States Lines, Pacific Mail, Pacific Steamship Company and the Munson Line. The daily papers were incorrect in announcing that all Board vessels would receive preferential classifications. This is not the case, nor that all twin-screw passenger vessels henceforth brought into use will be so classed. The steamship lines above mentioned are operating several former German owned steamers more than 20 years of age which will not benefit by the underwriters' recommendations.

Writing the "Majestic" Class

IT will readily be credited that the great interest aroused at the port of New York by the first appearance of the *Majestic*, the largest vessel afloat, was vividly shared by marine underwriters. Much sage council was passed along by the veterans of the profession anent the hazards that enter into the insuring of such tremendous ships as this. The laymen might be justified in concluding that a vessel so structurally perfect as the *Majestic* would offer the most

attractive kind of a risk for the insurer, and yet the average underwriter would much prefer a smaller boat. The very size of the *Majestic* makes her difficult to handle and this is of great importance to the underwriter when a vessel is entering or sailing from a port. Congested shipping conditions and narrow channels in the majority of the great ports make the danger of stranding and collision very real indeed. Vessels of the draft of the *Majestic* must come into New York on high tide, which means that, if such a ship is delayed by fog or other causes and arrives off Ambrose Channel and is compelled to anchor awaiting high tide or clearing of the fog, she may very easily drift on the shoals. When the *Majestic* encountered the swift tide off Quarantine she swung around at right angles, partially blocking the channel, which is only 1,800 feet wide at this point. It took skillful maneuvering to get her around so as to give sea room for the *Mauretania* to get by. Not only is the danger of stranding and collision materially increased in the case of large steamers, but the cost involved in getting such a monster off the strand would be decidedly greater than if it were a smaller vessel.

Rules for Inland Craft

RULES governing the construction of river, harbor and canal craft are under preparation by the American Bureau of Shipping, with a view of taking up the classification of the same. A number of vessels of these types have already been classed, and it has been found to be very advantageous to their owners in arranging their insurance on hulls and cargoes. Bureau officials are giving particular attention to the classification of the modern self-propelled barge and of tow barges, in view of the activity on the part of New York authorities in reviving interest in a more extended use of the Barge Canal. The Bureau, which is now located at 50 Broad street, New York, will welcome any suggestions from responsible builders, owners and underwriters with regard to these particular types of vessels, and will give such suggestions the most careful consideration and possibly include them in the forthcoming rules.

Short Policy Revised

THE American Institute of Marine Underwriters is giving consideration to the short form of marine insurance policy that has been the subject of so much discussion and revision during the last three or four months. Suggestions for alterations were received from a number of brokers whose criticism had been invited, and these suggestions have been considered with the result that recommendations for changes were sanctioned and the policy reprinted with the modifications included. It is to be hoped that the Institute will approve the recast document, as such a course would mark an important step toward the policy uniformity and simplicity so eagerly sought by banking and shipping interests. The new policy is intended also for use in insuring shipments to Great Britain, where the courts have ruled that consignees may demand the inclusion of actual policies, instead of the popular certificate, among C.I.F. papers.

"Endicott" Decision Reversed

A GREAT victory has been won by the Greater British Insurance Corporation, Ltd., of England, in the case brought against it by the Peninsular Transportation Company for contesting liability on the loss of the schooner *Charles G. Endicott*. The transportation company won a judgment last November for $5,000 and costs in the Special Term of the Supreme Court after the court had struck out the defendant's answer and given a summary judgment, without trial or consideration of the evidence for the plaintiffs. Appeal was taken to the Appellate Division of the Supreme Court and in an opinion concurred in by the entire court the orders appealed from are reversed, the plaintiff's motion to cut out the answer of the defendant and for judgment is denied, the insurance company's motion to vacate the judgment and for leave to file an amended answer is granted, and the judgment reversed with costs. The case now reverts to the lower court for retrial. The reversal was based both on evidence and on the extraordinary procedure of the court. This is the celebrated case in which after several of the American underwriters had paid their proportion of the loss the British companies contested liability, denying destruction by mines and alleging criminal collusion on the part of the owners in the destruction of the schooner off the coast of Cuba in February of last year.

Syndicates Officially Praised

SWEEPING commendation of the condition and achievements of the American Marine Insurance Syndicates has been accorded in the report of their examination by the New York Insurance Department, just filed. Albert N. Butler, who made the report, states that the Syndicates have accomplished what they were organized for, and pronounces their continued existence as an economic adjunct of the American merchant marine as eminently justified. Of Syndicate "A," which was organized for inspection damage and loss surveys of vessels of all types and classes, the report says that it has established an economical method of handling the operation and has become an important factor in securing repairs at much more reasonable figures than heretofore. It commends the low expense ratio maintained in the work of "B," which, inclusive of taxes and brokerage, reached but 12.44 percent of the earned premium. On account of larger brokerage allowances, the expense ratio of "C" was somewhat higher than that of "B," but even so it was but 21.29 percent of the earned premiums.

"There can be no doubt," reports Examiner Butler, "that Syndicate 'C' offers for the first time to the American market hull insurance adequate to meet practically all American requirements. The syndicates have, therefore, met the wishes of the Committee on Merchant Marine and Fisheries by providing greater American hull coverage . . . . It is a great convenience to brokers to be able to deal through the syndicates, thus quickly covering the capacity of the American market . . . . Economically, the underwriting syndicates appear to be highly successful. There are numerous necessary and expensive operations formerly duplicated by the various underwriters, that are now co-ordinated under the one head—underwriting, adjusting, surveying, settlements, etc. The expenses of the syndicates have been markedly low. Furthermore, there should be gathered under this one organization a mass of invaluable experience in regard to ships, owners and operators which must ultimately be extremely beneficial to efficient service to the assured and also the American mercantile marine . . . . As regards Syndicate 'A,' this organization may well develop into the powerful institution contemplated by its sponsors . . . . Should the profits indicated in the foregoing statement continue over a considerable period and, if such profits are found ultimately to represent economies effected by the syndicates, reduced rates of insurance to American shipowners should soon follow."

American Farmers and American Ships

(*Continued from page* 412)

France have come back to their home towns and farms with a new realization of what ships and more ships mean in peace and war to America. Those foreign foes of the American merchant marine who protest that all American farmers are opposed to a merchant marine of our own and will help Europe re-clinch her old monopoly of our ocean trade, simply do not know those farmers or their sons!

S. S. Moreton Bay—First of the Australian "Bay" Fleet

New Australian Liner Moreton Bay

Passenger and Cargo Vessel of 23,320 Tons Displacement to Operate Between the United Kingdom and Australia

ONE of the interesting post war developments of intercontinental passenger service is the construction of five combination passenger and freight vessels for operation between the United Kingdom and Australia. These vessels will be operated by the Australian Government Commonwealth Line and will be known as the "Bay" fleet. The *Moreton Bay* is the first of this fleet to be completed, the others being *Hobson's Bay, Jervis Bay, Largs Bay* and *Esperance Bay*.

On account of the long voyages these ships will have to make and the variations of temperature through which they will pass it was necessary to give special consideration to passengers and their comfort and in consequence a high standard of accommodation has been provided which has also been extended to include the crew's quarters and provide a maximum of comfort for them as well as the passengers.

The following particulars of the *Moreton Bay* will also apply to the sister ships.

Length over all	548 feet 9 inches
Length between perpendiculars	530 feet 0 inches
Breadth molded	68 feet 0 inches
Depth, molded, to shelter Deck "B"	43 feet 6 inches
Draft	29 feet 11½ inches
Displacement	23,320 tons
Sea speed in loaded condition	15 knots

The vessel is classed 100 A-1 at Lloyds, shelter deck with freeboard and was also built to satisfy the British Board of Trade requirements for passenger ships and, in addition, to comply with the Australian Navigation Act.

Hull

The new vessels have a forecastle forward and a long bridge amidships. Two pole masts are fitted and one funnel. Including the boat and bridge decks, there are six decks in the depth of the vessel, the upper decks being utilized for passenger accommodation and the lower decks and main holds for cargo.

A special feature of the construction is the large capacity of insulated space provided in numbers 2, 3, 4 and 5 holds and D and E 'tween decks. General cargo will be carried in numbers 1 and 6 holds and the 'tween deck spaces above on D and E decks.

Refrigerated Spaces

The refrigerated compartments are insulated by cork slabs embedded in bitumen and faced with a magnesite cement

which is proof against vermin or damp and preserves airtightness. These spaces will be utilized for the carriage of frozen meat, butter, eggs, rabbits, fruits, etc. In view of this and the fact that some of these must be carried at higher temperatures than others, the brine distribution is arranged on the three temperature system, by means of which brine for freezing or chilling and for thawing out can be supplied independently to each brine pipe section throughout the ship. Consequently each refrigerated space is controlled independently of all others according to the requirements of the cargo carried.

ACCOMMODATIONS

The new "Bay" ships are designed primarily to carry third class passengers but special first class cabins for 12 passengers have been provided on the bridge deck. These cabins are elaborately designed and furnished and each is arranged to include a private bathroom.

Third class accommodations for 720 passengers are provided practically the entire number of which are located on "C" deck. These accommodations are arranged in 2, 4 and 6 berth cabins and in the two foremost and two aftermost compartments the accommodations are portable so that when not required for passengers these spaces may be utilized for cargo. Access is gained to the third class accommodations through entrances erected on the shelter deck which also are fitted with lavatories, bathrooms, etc., for the passengers' use.

The public rooms are located on the shelter deck in way of the bridge superstructure. A large dining room is provided at the forward end and arrangements made for seating 350 passengers at one time. Right aft of the main dining room are arranged the pantries and galleys and directly abaft the galley are located accommodations for stewards, butchers, bakers, cooks, etc. The after end of the bridge enclosure is fitted up with a social hall on the port side and a smoking room on the starboard side, each of these public rooms having an open but protected veranda fitted directly abaft them. All of the public rooms are specially designed to provide for the greatest comfort and entertainment of the passengers, a feature which is most essential on long sea voyages, especially through tropical waters.

On the shelter deck aft, located so as to be completely isolated from all other erections, are hospitals consisting of separate rooms providing for male and female cases or for special cases requiring complete isolation. A special bathroom is provided for each ward and each is equipped along the most modern lines.

The captain's quarters are located forward on the boat deck and aft on the same deck in way of the engine room casing accommodations are provided for the firemen, these latter being arranged in a manner which enables the men to proceed to their work without using the passenger decks.

Third Class Smoking Room

First Class Dining Room

The ship's officers, doctor and purser are berthed on the bridge deck forward and the engineers on the bridge deck aft in way of the engine casing and No. 4 cargo hatch.

The crew is berthed in well ventilated, roomy quarters under the forecastle.

BOILERS

Steam is generated in three double ended and two single ended boilers designed for a working pressure of 220 pounds per square inch and arranged in a single boiler compartment. The boilers are of the multitubular return tube type fitted with smoke tube superheaters and Howden's forced draft.

Arrangements have been made to burn oil fuel but the necessary gear is carried for converting to coal burning should the necessity arise.

MAIN PROPELLING MACHINERY

The main propelling machinery consists of turbines of the Parson's reaction type driving twin screws through double reduction gearing. The installation is rated at a collective shaft horsepower of 9,000 with the propeller revolutions about 90 per minute. The astern power is approximately 63 percent of the full power ahead. The high pressure pinion of the first reduction gearing is driven through a flexible coupling by one stage of impulse blades at the forward end of the high pressure turbine and the low pressure pinion is driven through a flexible coupling by the low pressure turbine. The unit is designed to operate with 100 degrees F. of superheat at the high pressure inlet.

Adjusting blocks of the Michell type are fitted to the turbines.

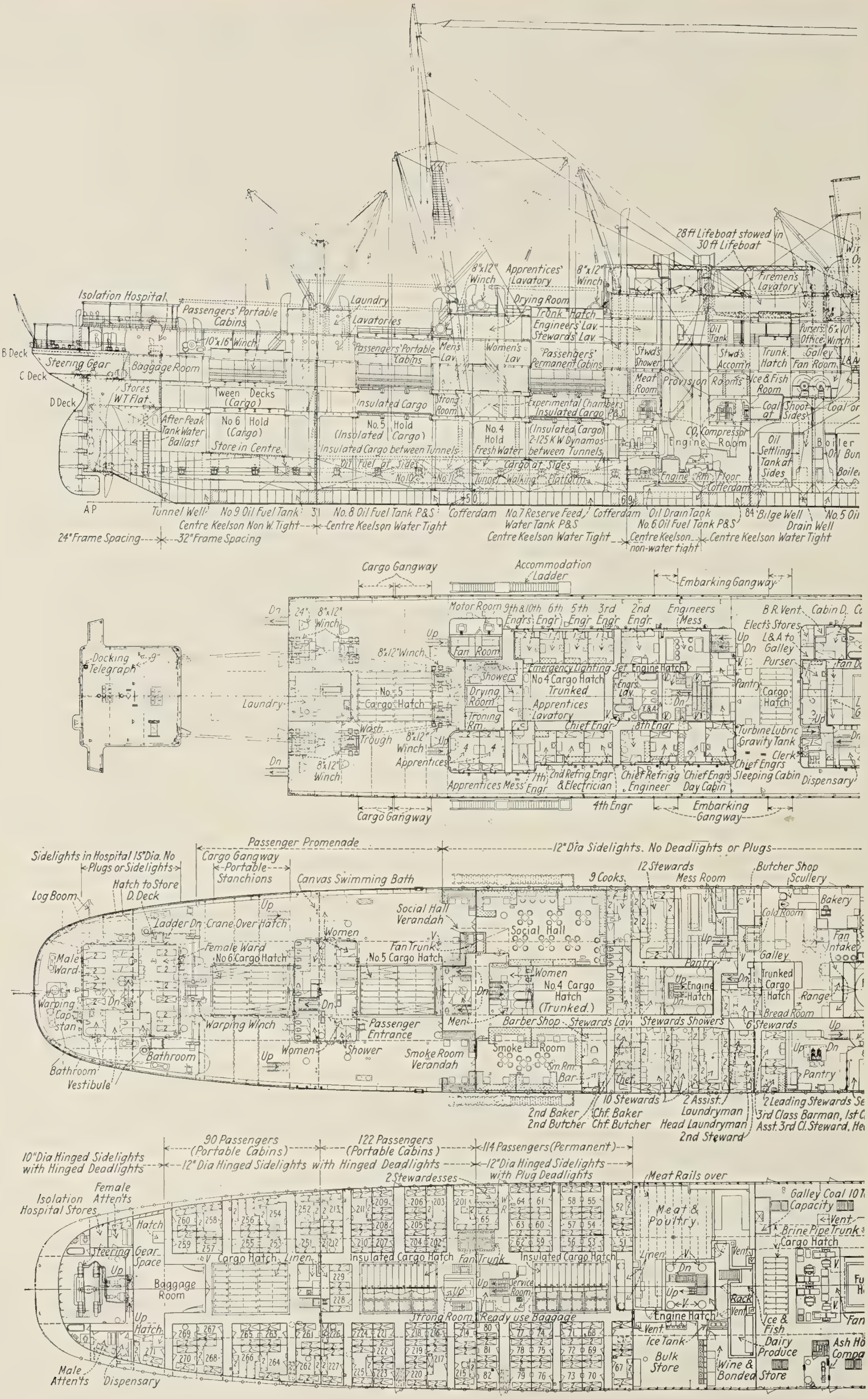
The reduction gearing is of the helical type, the main gear wheel consisting of a cast iron center portion upon which a heavy forged steel rim is shrunk and first and second reduction pinions or forged nickel steel. Forced lubrication is used for the turbines, shaft bearings and gearing.

Thrust blocks of the Michell type are fitted adjacent to the reduction gears.

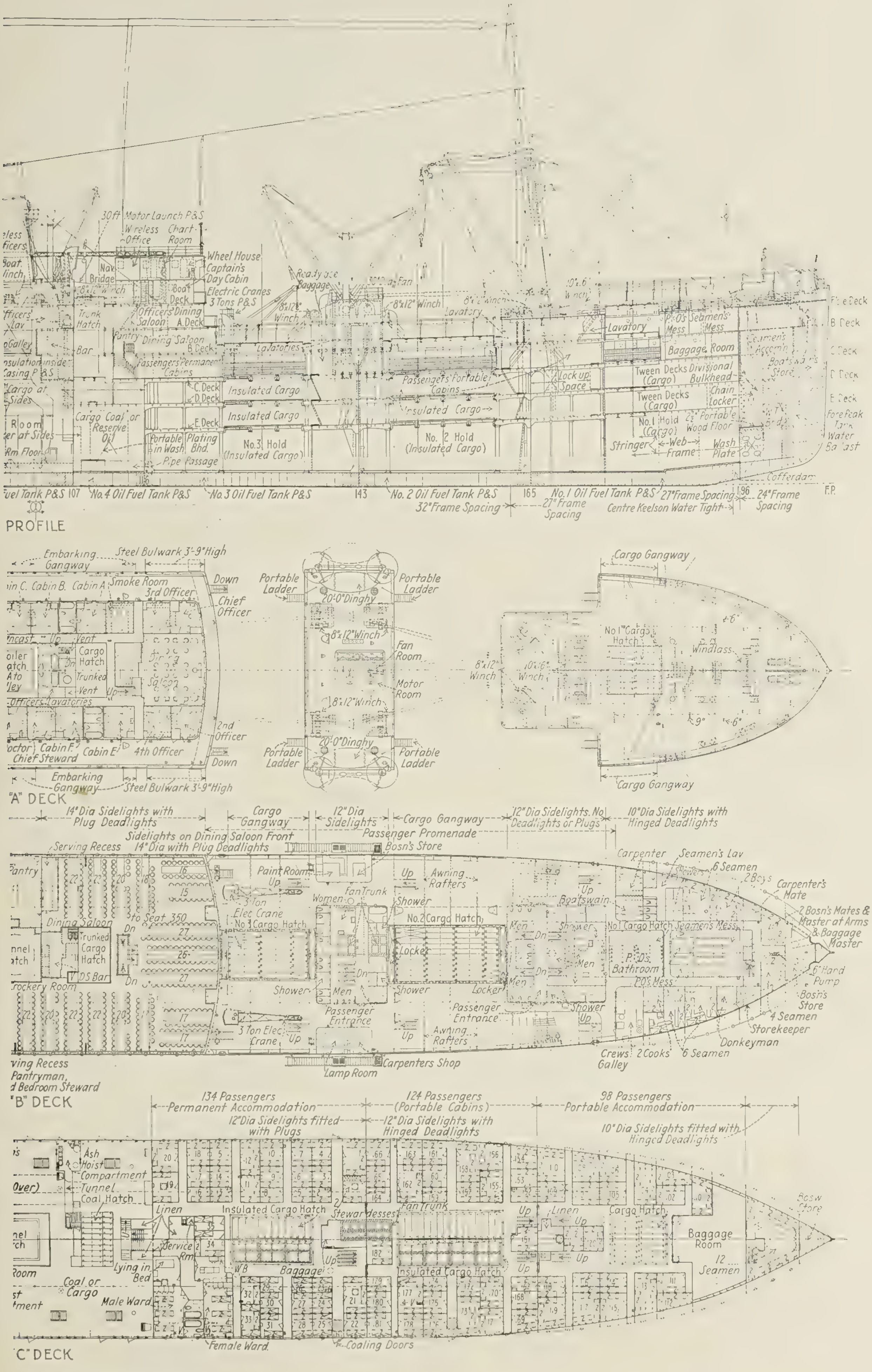
The condensing plant installed is capable of maintaining a vacuum of 28 inches when the engines are operating continuously at full speed with a barometer of 30 inches and sea water at 80 degrees F. The main condensers are of the "Contraflo" type underslung on the low pressure turbines so that the low pressure turbine is always free from drainage water. The vacuum system embodies all the latest improvements for economical and efficient operation in conjunction with the feed heating system. "Contraflo" marine specialties are provided throughout.

The auxiliary condenser is also of the "Contraflo" vacuum type, and the auxiliary feed system is similar to the main system.

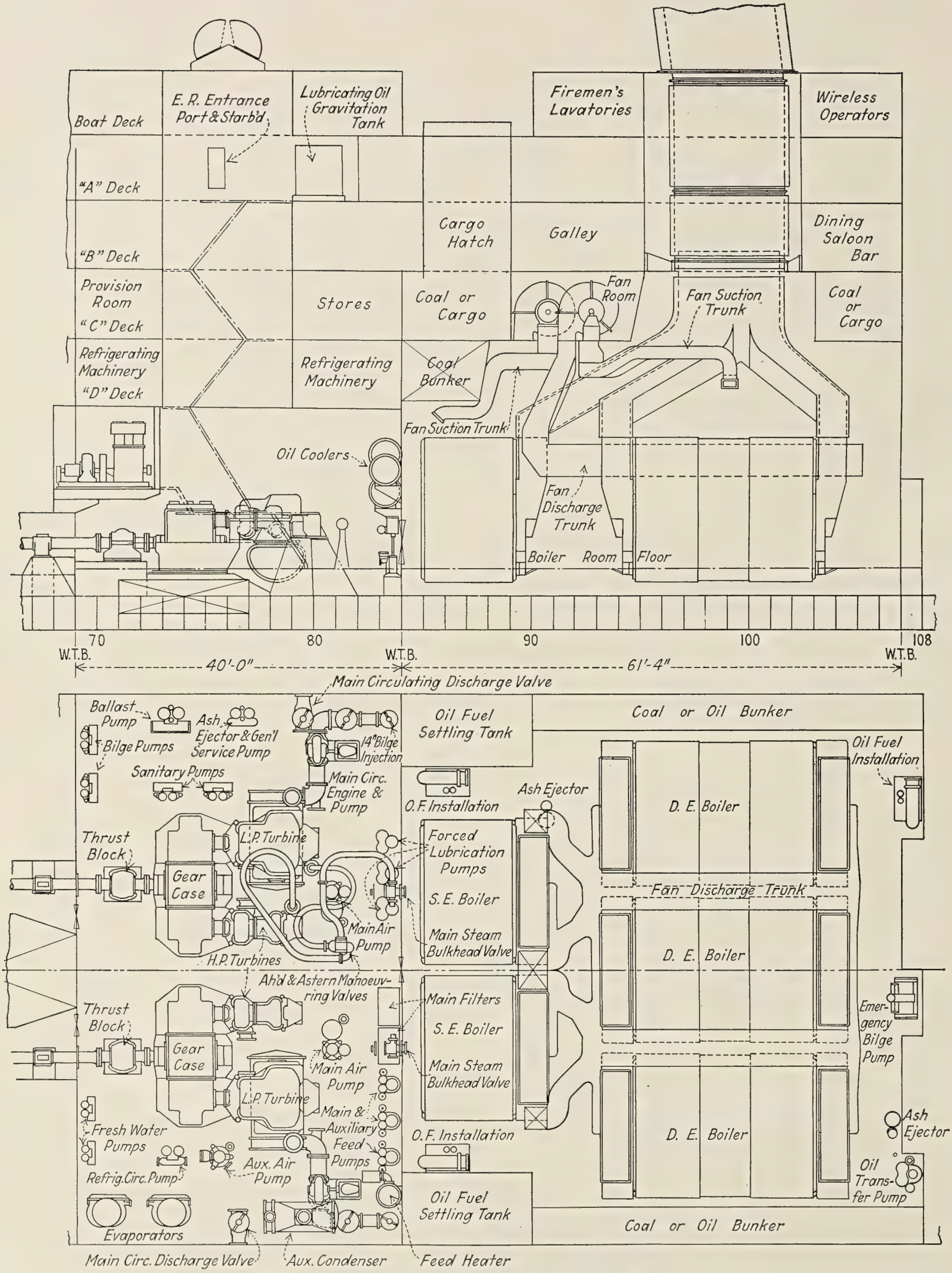
The turbine turning gear is operated by electric motors



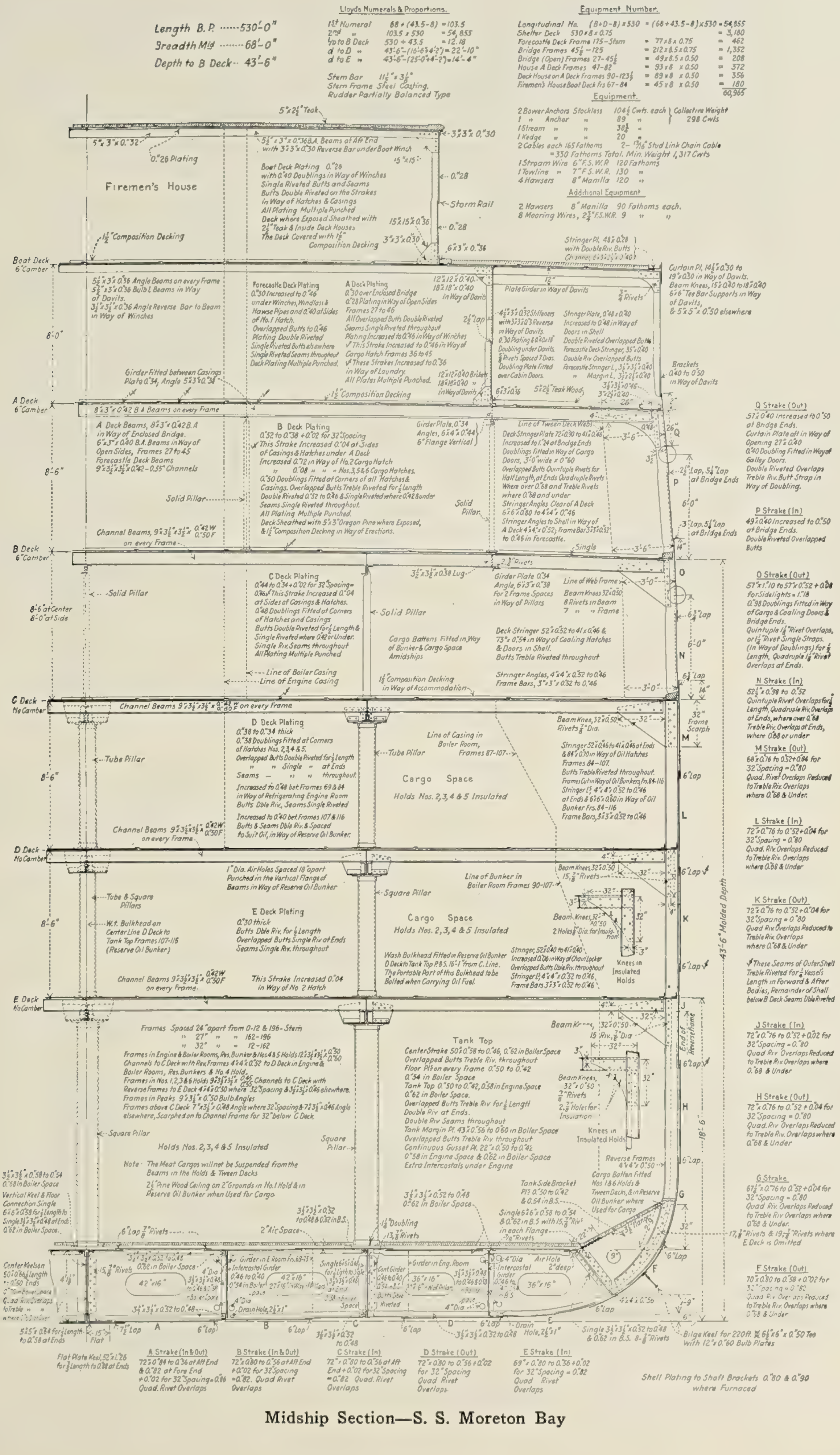
General Arrangement Plans



of S. S. Moreton Bay



Machinery Arrangement, S. S. Moreton Bay



Midship Section—S. S. Moreton Bay

and is arranged above the floor in order to provide the greatest accessibility.

Vickers system of lubrication is used in way of the stern tubes.

Four bladed propellers of the built-up type are fitted, the manganese bronze blades being bolted to a cast steel hub.

All valves on the superheated steam lines are made of cast steel with forged steel fittings and valve faces of nickel alloy.

Safety Provisions

Every attention has been given to providing means for reducing the risk at sea and providing the most modern facilities for insuring the safety of passengers.

In general, the subdivision of the vessel complies with the full requirements laid down by the International Convention for the Safety of Life at Sea. Watertight doors located below the waterline are arranged so that they may be operated both by hand and by the Stone hydraulic system from the bridge or from either side of the bulkhead at the door itself. Fire bulkheads have also been arranged in the superstructure as required by the "Convention" and in the event of fire in any compartment, that compartment can be effectively isolated until the fire is extinguished.

A water service system for fire extinguishing purposes and a special steam fire extinguishing system for the main holds, with connections for steaming out double bottom and fuel oil tanks, is also fitted. Special fire extinguishers are also fitted in racks throughout the several compartments in accordance with the rulings of the "Convention."

Sea risks have been further reduced by the provision of lifeboats sufficient to accommodate the ship's full complement. The boats include:

Two 30-foot motor launches equipped with wireless,
Six 30-foot lifeboats,
Six 28-foot lifeboats,
Two 20-foot dinghies.

Lifeboat davits of the Australis type have been fitted.

Life jackets and life buoys are available throughout the accommodations and a powerful wireless installation is carried on the boat deck.

Cargo Handling Gear

Special attention has been given the cargo handling gear fitted aboard the *Moreton Bay* as efficient cargo handling is essential to economical operation of any vessel and particularly in a vessel handling refrigerated or similar perishable cargoes.

The cargo and derrick gear of the *Moreton Bay* have been designed to eliminate lost motion. The gear includes 18 tubular steel derricks of 5 tons capacity, four of 3 tons and one designed to handle heavy loads up to 35 tons. The arrangement provides for four booms stepped on tables at each mast, the 35-ton derrick being stepped on the forecastle deck at the base of the foremast and the remaining booms stepped on derrick posts which are fitted with cowls and also utilized as ventilators. Two 3-ton electric cranes are installed on "B" deck in front of the bridge.

A total of 23 winches has been provided and distributed as follows:

One, 16 by 10 inches, aft, for warping purposes
Two, 16 by 10 inches, on forecastle for warping, handling cargo, and operating the 35-ton derrick
Eighteen, 8 by 12 inches, located in way of cargo booms
Two, 6 by 10 inches, for operating cargo booms

Six of the cargo winches on the boat deck are specially adapted for working 8 "Maces" boat winches through a chain drive.

Auxiliary Machinery

A steam windlass of high power and speed, with nigger heads on each side for warping, is located on the forecastle.

One steam capstan, 12½ by 10 inches, is fitted aft.

The steering gear is of the Vickers electric hydraulic type consisting of two complete gears, each operated by a Williams-Janney variable delivery pump and controlled from the navigating bridge by means of a telemotor installation.

The refrigerating machinery consists of two horizontal, compound, marine type engines, 14 by 26 inches diameter by 21 inches stroke driving one horizontal double acting CO_2 compressor. These machines, together with the necessary gas condensers, separators, circulating pumps, etc., are erected on "D" deck over the engine space.

Ventilation in the insulated holds and 'tween decks, when carrying fruit, is accomplished by the installation of four large Sirocco fans. The ventilation of the passenger and crew accommodations is effected by natural means and additional cowl ventilators are supplied for exhaust from the holds.

Fresh water storage tanks are constructed between the shaft tunnels and in addition large fresh water tanks are located over the firemen's quarters on the boat deck.

An emergency lighting set, operated by a Diesel oil engine and having a 35-kilowatt capacity, is located in a house above "A" deck and used to supply current for lighting the vessel in the event of a breakdown of the main generators.

Steam heating is provided for throughout the vessel, radiators installed in the various compartments being arranged so that the temperature may be regulated to suit those occupying the compartments.

In all, the vessel constitutes a most skillfully designed structure, both from the aspect of its special trade and particularly with regard to the comforts and conveniences of the accommodations for both passengers and crew.

The *Moreton Bay* was constructed in the shipyard of Messrs. Vickers, Ltd., at Barrow-in-Furness and to this yard was also awarded the contract for the *Hobson's Bay* and *Jervis Bay*. Contracts for the *Largs Bay* and *Esperance Bay* were awarded the William Beardmore & Company, Ltd., of Dalmuir.

Electrically Operated Coal Barges in Service on San Francisco Bay

By Charles W. Geiger

TWO coal barges have recently been placed in operation on San Francisco Bay, which are operated by electric motors, current for same being generated by a gasoline engine driven generator.

The superstructure on these barges carries a trolley suspended from a beam and operating a grab bucket. A 16 horsepower motor operates the trolley back and forth along the track on the superstructure, a 30 horsepower motor raises the grab bucket and a 30 horsepower motor opens and closes the bucket. These motors are placed in the main engine room, which is of steel construction and occupies one end of the barge.

The superstructure carrying the track enables the trolley and grab bucket to be extended out over the coal in the hold of the barge, when the grab bucket is lowered, picks up a load of coal, is raised to the trolley and the trolley and grab bucket is moved to the center of the barge directly over a receiving hopper. When the bucket is opened the coal drops into this receiving hopper, which in turn discharges the coal into a skip or elevator bucket. This elevator bucket is then elevated by electric motor and when at the proper height automatically discharges its contents into a chute which leads into the bunker of the steamer.

One of the most novel features in connection with this barge is the control room, shown in Fig. 3. In the foreground can be seen the controls for the three motors operating the trolley and grab bucket. In this room there are telltale

Fig. 1.—General View of Electrically Operated Barge Delivering Coal to a Japanese Liner

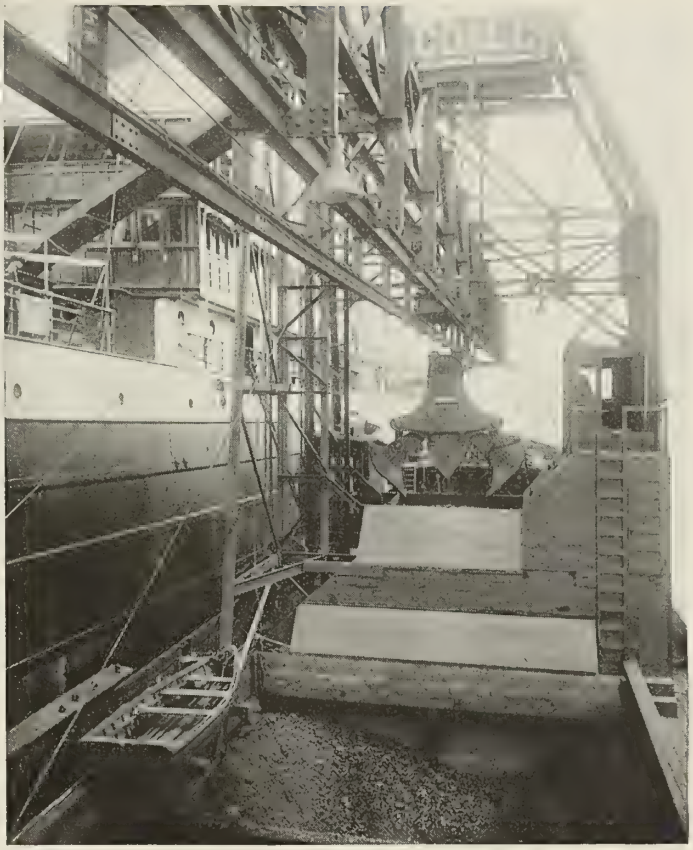


Fig. 2.—Close-up View of Barge Showing Grab Bucket in Action. No Shoveling Is Required

lights which enable the operator to know exactly where the grab bucket is without the necessity of looking, although he has an unobstructed view of the bucket at all times, the control room being provided with windows on three sides and with iron gratings in the floor.

After the operator opens the grab bucket, which delivers the coal into the central hopper, he opens a gate in the central hopper, which discharges the coal into the elevator bucket. When he is ready to discharge the elevator bucket into the bunkers of the steamer, the operator presses a button shown at *A* in Fig. 3 which raises the elevator bucket to the proper height, turns the bucket over so that the contents run into a chute, holds the bucket in this position (by means of a relay) until the coal has all been discharged into the chute, reverses the motor and lowers the elevator bucket to the proper position under the central hopper ready to receive another batch of coal. This is all done without any attention on the part of the operator, other than pressing the push button. It will be seen that there are three push buttons for the operation of the elevator bucket, one for the purpose of stopping the elevator bucket at any point and the other to reverse the elevator bucket.

There is a main switch in the engine room, which can be opened and closed by means of two push buttons in the control room. By this means the main switch can be opened or closed by the operator from the control room, making it unnecessary to operate the main switch by hand, although this is possible. In the control room there is an emergency switch operated by a push button. By pushing this button, every motor on the barge is instantly stopped. This is a very desirable "safety first" feature.

The generator is mounted on the engine bed and is direct connected to a four-cylinder, 125 horsepower gasoline engine, operating at 280 revolutions per minute. Distillate is used for fuel, only ten gallons being required per hour when the barge is operating at full capacity. Each barge

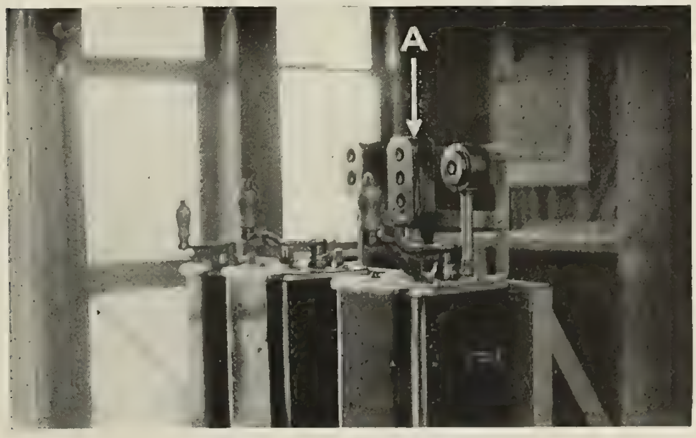


Fig. 3.—Control Room

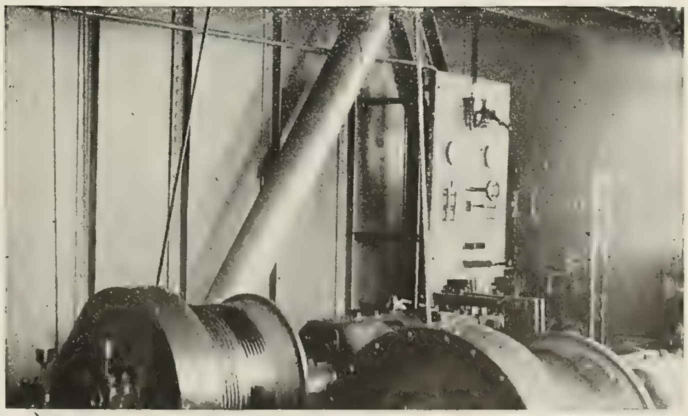


Fig. 4.—Engine Room, Showing Main Switchboard

has a capacity for delivering 100 tons of coal per hour into the bunkers of steamers.

In connection with these barges there is operated a traveling gantry crane electrically driven. The rails on which the crane runs have a gage of 200 feet. The length of travel along the bulkhead is 550 feet, current for operating the motors being obtained by a third rail system. This gantry bridge is equipped with a grab bucket capable of picking up two tons. This is used in discharging coal from cars. There is an extension out over the water by means of which the coal can be delivered direct from cars to the barges, or from the storage pile to the barges. This gantry crane is also used for handling crushed rock and sand from barges to cars or to storage yard.

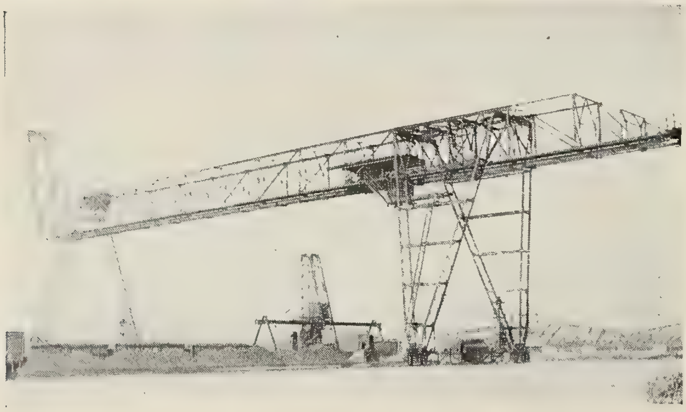


Fig. 5.—Traveling Crane at Standard Oil Plant in Alameda. One of the Electrically Operated Coal Barges Can Be Seen in the Distance

New Mooring and Maintenance Tenders in Service in Mexican Waters

Of the two duplicate steel mooring and maintenance tenders recently designed by Whittelsey and Whittelsey, naval architects, of New York, and built by Kyle and Purdy, City Island, New York, the *Toteco,* owned by the International Petroleum Company of New York, has been in service in Mexico continually for about eight months, and the *Tacomonte,* owned by the Atlantic Gulf Oil Company of New York, has recently arrived and gone into service in the same waters. Both vessels are classified by the American Bureau of Shipping.

As these vessels are required for almost constant service for the maintenance of sea loading stations, including repairs to pipe lines, mooring buoys, etc., their design and construction are very rugged throughout and the machinery and equipment are laid out with the idea of simplicity and accessibility in order that the operation and any necessary repairs may be carried out with the facilities at hand. This service requires accommodations for rather a large mooring and maintenance crew, provided for in the forecastle, aside from the ship's crew, which is housed in the deck house.

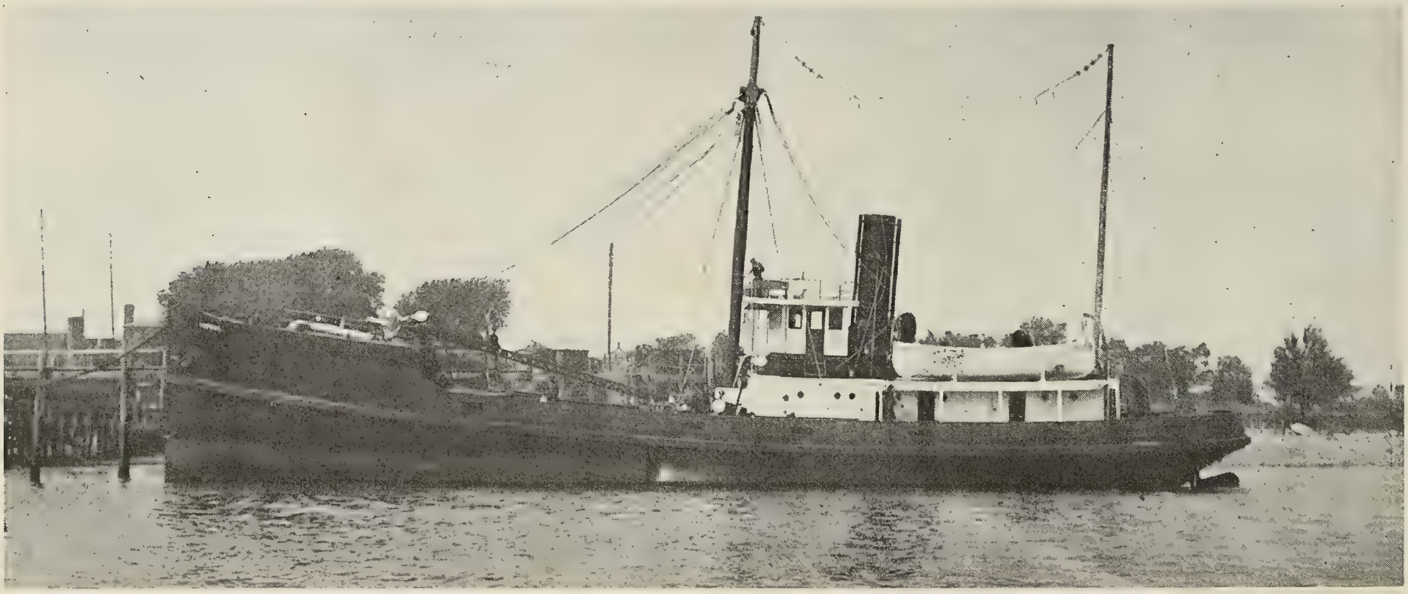
The principal dimensions of the vessel are as follows:

Length overall	133 feet 8 inches
Length on load waterline	126 feet 9 inches
Beam, molded	32 feet 0 inches
Depth	14 feet 6 inches
Draft (mean)	10 feet 6 inches
Draft (maximum)	11 feet 0 inches

The hull is of steel, with steel decks and deck houses and a wooden wheel house. Propulsion is by a four-bladed propeller driven by a surface condensing compound engine with cylinders 18 and 38 inches in diameter and 26 inches stroke developing 500 indicated horsepower at 105 revolutions per minute. Steam is supplied by a two-furnace Scotch boiler having 2,000 square feet of heating surface and equipped with the Todd fuel oil burning system and forced draft. The main condenser has 1,000 square feet of cooling surface and the engine room auxiliaries comprise a hot well, Reilly feed water heater, two vertical feed pumps, fire and bilge pumps, centrifugal circulating pump, sanitary pump, fresh water pump, air pump, injector, syphon and fuel oil set, all steam driven.

For handling heavy weights there is a steel derrick operated by twin Lidgerwood hoists. The falls, of Durable wire rope, have a capacity of 15 tons on a seven part line. The deck machinery includes a Hyde steam windlass and steam steering gear. Adjacent to the galley is a 1 ton Brunswick, steam driven, direct expansion, refrigerating machine. Electricity for lighting is supplied by a 10 kilowatt General Electric steam driven generator and a 2½ kilowatt Cutting and Washington wireless set is provided.

On her maiden voyage from New York to Tampico the *Toteco* averaged a speed of 9.3 knots, which is about a knot faster than anticipated in view of the fact that the vessel was fitted with a towboat type wheel.



International Petroleum Company's Mexican Sea Loading Station Tender Toteco

Motorship Teneriffa: Length, Between Perpendiculars, 425 Feet 5½ Inches; Beam, Molded, 55 Feet; Depth, 38 Feet 6 Inches; Draft, Loaded, 29 Feet ¾ Inch; Displacement, Loaded, 15,025 Tons; Deadweight Capacity, 10,875 Tons; Indicated Horsepower, 3,100; Speed, Designed, 11¼ Knots

Norwegian Motorship Teneriffa

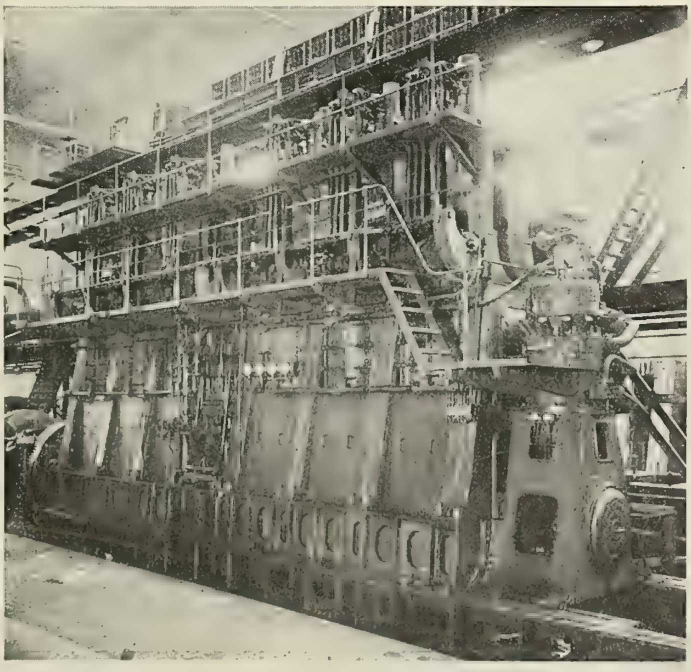
Twin Screw Cargo Ship of 11,000 Tons Deadweight Built by Burmeister and Wain

By Our Special London Correspondent

THE motorship *Teneriffa,* the first of three oil engined vessels being built by Burmeister and Wain for Wilhelm Wilhelmsen, the well known Christiania shipowner, ran her trials in May. She is a standard vessel similar to many which Burmeister and Wain has built for other owners, having a deadweight capacity of about 11,000 tons. The length is 425 feet, the beam 57 feet and the speed is 11¼ knots on a fuel consumption of 10 tons daily.

The *Teneriffa* is a pure cargo vessel, with accommodation for about a dozen passengers. The machinery equipment is of the well known Burmeister and Wain standard design comprising two sets of six cylinder four cycle engines developing 1,550 indicated horsepower at 120 revolutions per minute and having six cylinders 630 millimeters bore and 960 millimeters stroke.

The control of the engine is, as usual, effected by a small reversing and two starting throttle levers. On actuating the former a servo motor is brought into operation which lifts the push rods off the camshafts, moving the camshafts fore and aft and bringing the astern cams below the push rods; afterwards the latter are brought into contact with their cams. The engine is then in a position to run in the astern direction and by moving both of the starting and throttle levers forward, starting air is admitted to all six cylinders. A further movement of these two levers causes the fuel pumps to be brought into operation and the starting air is cut off.



One of the 1,550 Indicated Horsepower Diesel Engines Installed in the Teneriffa

The engines will run down to a minimum speed of about 60 revolutions per minute which is sufficient for all maneuvering purposes. The air injection compressor of the three stage type is driven off the forward end of the main crank shaft supplying air at a pressure of 68 atmospheres.

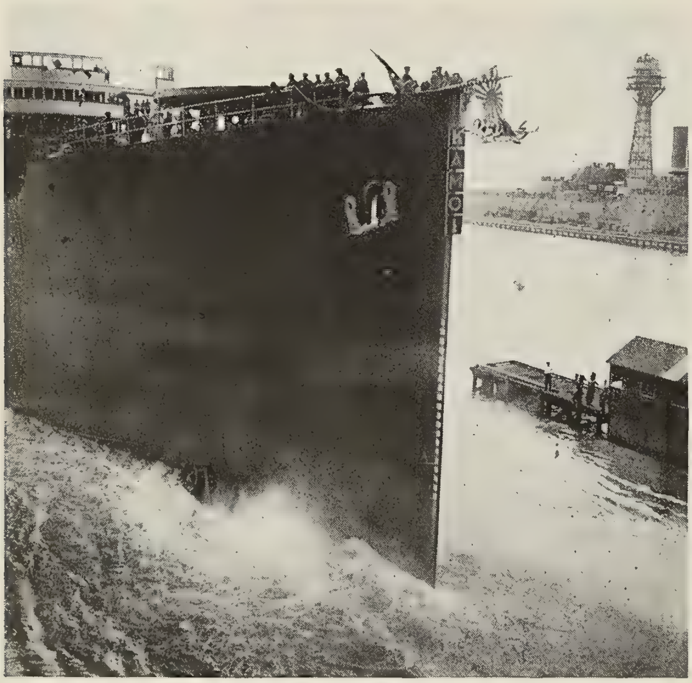
Fuel is carried in the double bottom, the total capacity being 1,800 tons while 15 tons of lubricating oil are allowed for.

The auxiliary plant is electrically operated and three Diesel driven dynamos of 90 horsepower running at 300 revolutions per minute are installed in the engine room for this purpose. They supply power to the three lubricating pumps, the piston and circulating water pumps and the other auxiliaries in the engine room. In addition, the electrical plant comprises 12 three-ton cargo winches, the windlass and an electric hydraulic steering gear. There is a single electrically driven air compressor installed in the engine room in addition to a small emergency set for the same purpose, which is steam driven and is of course only brought into operation in case of complete loss of air on the ship. A donkey boiler is fitted which supplies steam to this engine, in addition to generating steam for heating the cabins.

During the official trials of the *Teneriffa,* which were held over a measured mile course on May 3, the vessel displaced 4,802 tons on an average draft of 10 feet 4¾ inches and developed an average of 3,383.8 indicated horsepower at 138.4 revolutions per minute, giving the vessel an average speed of 12.29 knots. During the consumption test, the main engines developed 3,254.49 indicated horsepower at 134.6 revolutions per minute with a fuel consumption of 0.2973 pound per indicated horsepower per hour, including the consumption of the auxiliary engines producing the necessary current for the auxiliary machinery, steering engine and electric lights. The fuel oil used had a calorific value of 18,450 British thermal units.

Japanese Fuel Ship Kamoi Launched by New York Shipbuilding Corporation

THE twin screw, fuel supply ship *Kamoi,* launched on June 8 at the yards of the New York Shipbuilding Corporation, Camden, N. J., and christened by Madam Saburi, wife of the Charge d' Affaires of the Japanese Embassy, Washington, D. C., and daughter of the famous Marquis Komura, is the first electrically propelled ship of the Imperial Japanese Navy. On a length of about 500 feet and a designed draft of 28 feet the vessel has a displacement of 20,000 tons and a deadweight carrying capacity of about 13,000 tons. She is designed to carry 10,000 tons of oil; provision also being made for alternately carrying about 2,000 tons of bunker coal.

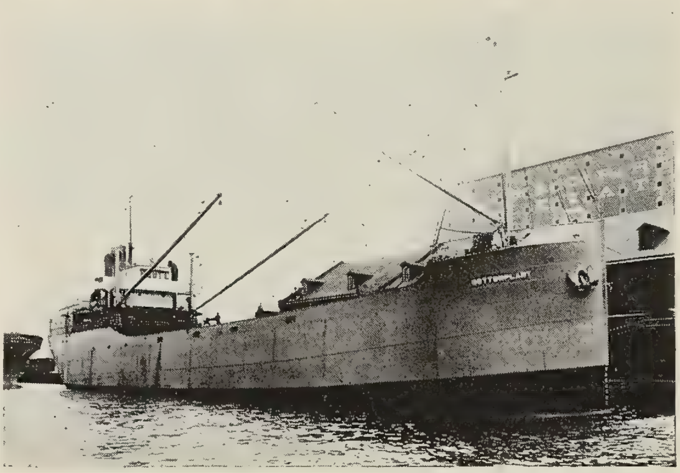


Launching of the Kamoi

The vessel is electrically propelled and is expected to achieve a speed of 15 knots with 8,000 shaft horsepower. The boilers are of special design and are coal fired; provision being made, however, for auxiliary oil firing.

Great Lakes Type Freighter Converted to Oil Burner

THE S. S. *Cotton Plant,* a Great Lakes type freighter owned by the Pacific Lumber Company of San Francisco, Cal., has recently been converted from a coal to an oil burner for use in the lumber trade on the Pacific Coast. Installation of the oil burning equipment, consisting of a complete Bethlehem-Dahl mechanical system, was carried out by the Baltimore Dry Docks Plant, Baltimore, Md., of the Bethlehem Shipbuilding Corporation, Ltd.



S. S. Cotton Plant Converted to Oil Burner

The *Cotton Plant* was built for the United States Shipping Board in 1919 by the Great Lakes Engineering Company at Ecorse, Mich., and was recently purchased by the Pacific company. The following are her principal dimensions:

Length	253 feet 4 inches
Beam	43 feet 7 inches
Depth	24 feet 5 inches
Capacity	4140 deadweight tons
Speed	10 knots
Boilers	2 Scotch, 13 feet 6 inches by 11 feet
Engine	1 three-cylinder, triple-expansion

New Airplane Compass.—A satisfactory type of airplane compass has been invented by Doctors Paul R. Heyl and Lyman J. Briggs of the Bureau of Standards, of the Department of Commerce. Flying tests with this instrument have been made, and the air service is now engaged in putting a number of models into service. The instrument weighs only 13 pounds, while the weight limit set by the air service was 25 pounds.

The new compass depends for its action not on a magnetic needle, but upon a revolving coiled wire. This principle is by no means new, but it has remained for the Bureau of Standards to apply it in such a way as to make the device practically operative under the very severe conditions prevailing in actual flight or airplane stunts.

The problem of perfecting a satisfactory aircraft compass was given the Bureau of Standards about a year ago. At the end of the war no completely satisfactory compass had been devised. Its importance to aviation is apparent when it is remembered that no airplane compass heretofore perfected has been able to keep up with the evolutions of a plane in all kinds of service.

Diesel Electric Schooner Yacht Alcyone

Three-Masted, 168-Foot Yacht Equipped with Winton-Diesel Westinghouse Electric Auxiliary Propelling Machinery

By H. C. Coleman*

WHEN Henry W. Putnam, of New York City, owner of the three-masted auxiliary schooner yacht *Alcyone,* found it necessary to replace the old reciprocating engine drive on his boat, he was so impressed with the many advantages of the Diesel-electric system of propulsion that he gave orders for the removal of the engines, boilers and auxiliaries and for the installation of two Diesel engines with electrical transmission of power to the propeller. As a result of his decision to adopt this most modern development in marine propulsive equipment, there passed down the lower bay in New York Harbor recently, on her sea trial, one of the finest equipped and easiest handled little vessels we have ever seen.

Fig. 1.—Auxiliary Schooner Yacht Alcyone

The *Alcyone* (Fig 1) is registered at 420 gross (262 net) tons and is 168 feet long overall, with a beam of 30 feet and draft of 15 feet. She has been completely refitted and overhauled. A large deck house had been added to the quarters amidships.

The propelling plant of the yacht consists of two six cylinder, Winton Diesel engines, direct connected to Westinghouse direct current generators, which supply a double unit motor, direct connected to the propeller shaft. Each engine is rated at 225 horsepower at 250 revolutions per minute. Each engine drives a 140 kilowatt, 125 volt, shunt wound, direct current generator and a 15 kilowatt, 125 volt compound wound exciter. The exciters are operated at 900 revolutions per minute, being driven by Morse chains from the main generator shafts.

The engine and generator, together with the generator bearing, are mounted on a rigid cast steel semi-bedplate, as shown in Fig. 2, making the unit convenient to handle and secure in the boat. The sets are placed abreast of each other in the vessel, with the exciters mounted outboard and supported on structural steel work, securely fastened to the ship frames. Fig. 3 shows the engine room looking forward from the motor room door.

The generator bearings are of the standard sleeve type with oil ring lubrication. Provision is also made for forced feed lubrication from the engine oiling system, as an auxiliary method of oiling the bearings.

The propelling motor is of the double unit type, consisting of two field structures and two armatures mounted on a common shaft, supported by two pedestal bearings. It is rated at 350 horsepower, 250 volts, 175 revolutions per

*Marine section, general engineering department, Westinghouse Electric & Manufacturing Company.

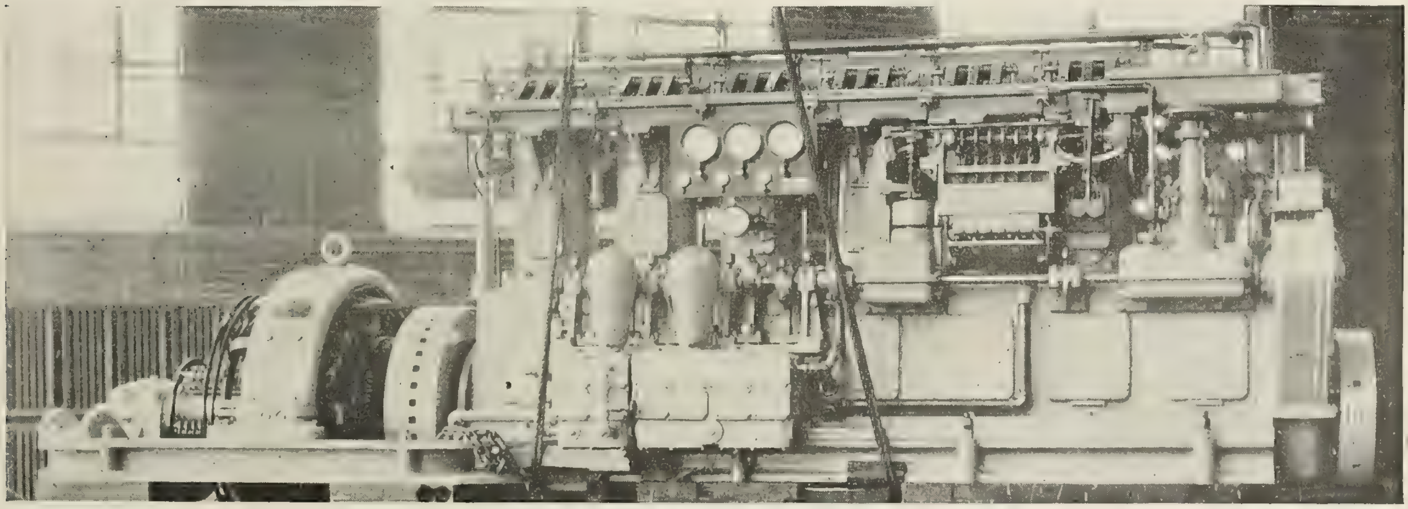


Fig. 2.—One of the Two 225 Horsepower Winton Diesel Engines Connected to a 140 Kilowatt Westinghouse Generator

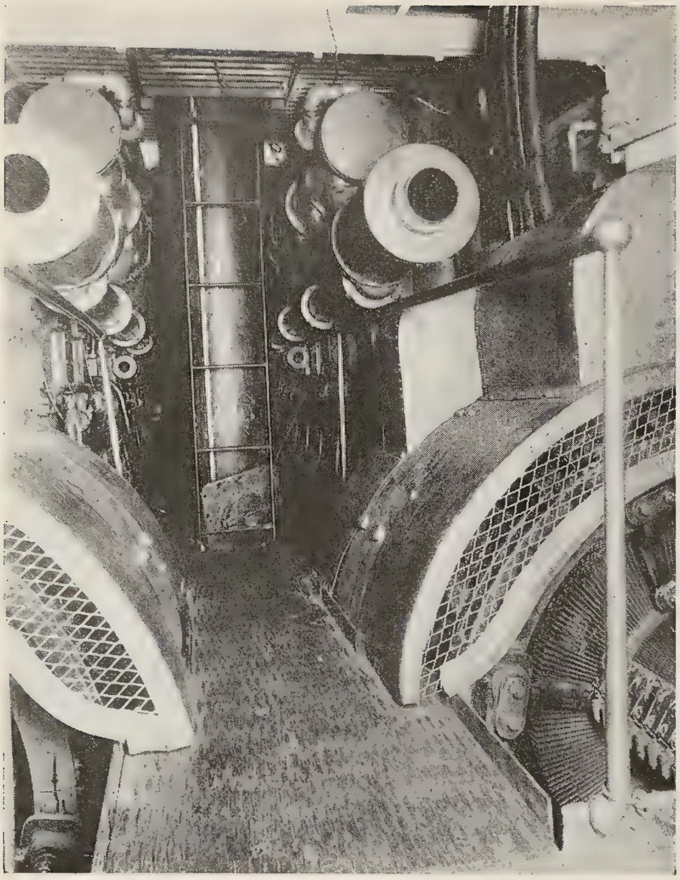


Fig. 3.—View in Engine Room, Looking Forward From Motor Room Door

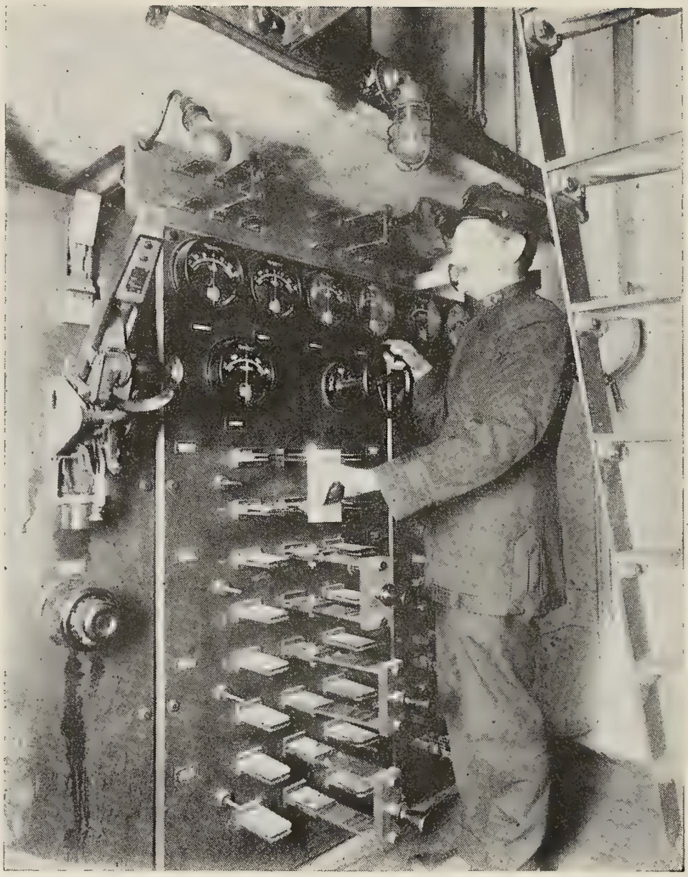


Fig. 4.—The Control Board for Propelling Equipment, Showing Chief Engineer Operating the "Master Controller"

minute, and is of the shunt wound, self-ventilated type. The bearings are duplicates of those used on the main generators. They are fitted with an auxiliary gravity feed oiling system, consisting of a small reversible geared oil pump, direct connected to the front end of the motor shaft and mounted on the bearing pedestal, and an oil reservoir to which the pump lifts the oil from the bearing overflow connections. A by-pass with pressure gage and valve for regulating the pressure is provided in the piping system.

The motor is located well aft where the lines of the vessel are very fine, necessitating the use of a double unit machine. The frame supporting feet are located near the horizontal centerline of the motor and are carried on steel beams secured to the ship's framing. The bearing pedestals are supported on yokes, the ends of which are mounted on the side beams which carry the motor field frames. The shaft is flanged and is bolted directly to the propeller thrust shaft.

The motor room is ventilated by a motor driven blower located in the engine room.

Control

The most interesting feature of the installation is the control, which must provide for ease of operation, responsiveness to the action of the operator and absolute reliability in the handling of the ship under all conditions. It must be simple and still provide for the maximum of flexibility of operation. It must protect the machinery against dangerous overloads, and still prevent damage to the ship, due to loss of power in an emergency. All of these requirements are admirably met by the control equipment which has been installed on the *Alcyone.*

Fig. 4 shows the complete control board for the propelling equipment, as installed on this boat. It is mounted fore and aft on the starboard side of the flat above the after end of the engine room.

The Ward Leonard scheme of control is used, whereby the starting, reversing and complete speed control of the motor is effected by adjusting the excitation of the separately excited, main generators. This makes the actual operating, or "master controller" part, so to speak, very small, simple and easy to handle, since only the generator field current has to

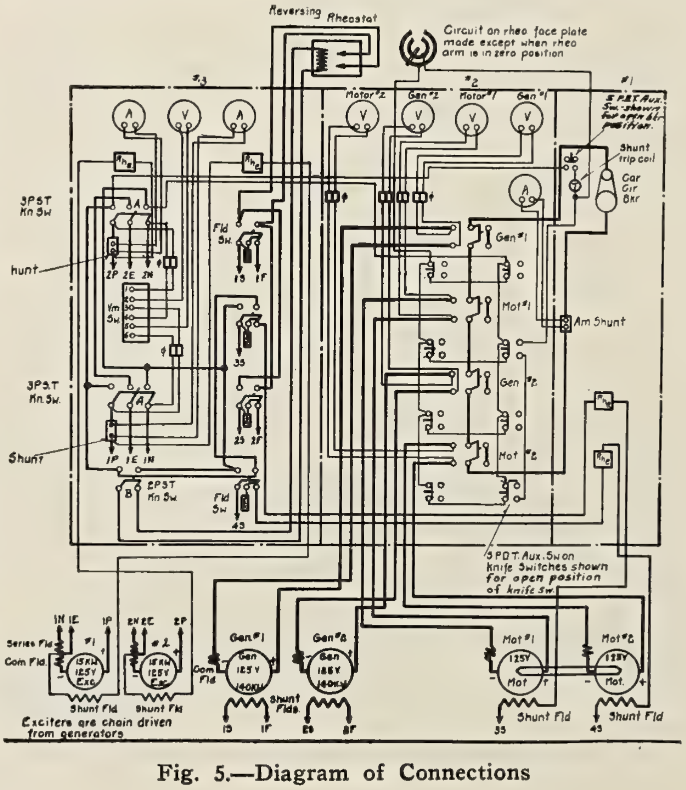


Fig. 5.—Diagram of Connections

be handled. This current is only about 1½ percent of that in the main armature circuits.

Master Controller

The "master controller" consists of a reversing rheostat located behind the switchboard and operated through chain and sprockets, from the main control hand wheel on the face of the panel, shown in Fig. 4. The same panel carries a double pole, double throw, knife switch, for each main generator and each motor armature. As will be seen from the diagram of connections, Fig. 5, the two generators may be connected in series with the two motor armatures also connected in series, by closing the switches to the left side. This is the running condition for full power operation. By closing the proper switch to the right side, either generator or either motor armature may be cut out of the series circuit, allowing for operation on the remaining units, connected in series. These switches are electrically interlocked with the circuit breaker so that any movement of them with the reversing rheostat in any position, except the "off" position, will trip the breaker; also the breaker will not remain closed, if the motor switches are both in the short-circuit position.

Convenient to the main control hand wheel is an ammeter, showing the operator the load on the motor, either ahead or astern, the instrument dial being marked accordingly. Above, on the same panel are two generator voltmeters and two motor voltmeters. All instruments have black dials with white scales and pointers, making them very easy to read in such a location.

Circuit Breaker

On the adjacent panel is the carbon circuit breaker which is set to open only on extreme overloads. It is not possible in ordinary maneuvering to obtain loads sufficient to trip the breaker and jeopardize the safety of the ship; as for instance in docking. This panel also carries two motor rheostats with concentric handles. With these, the fields can be adjusted so that the two armatures divide the load equally, as shown by equal readings on the two motor voltmeters. Then the two rheostat handles are clutched together, and operated as one thereafter.

Rheostats and Switches

The third panel carries the instruments, rheostats and switches for the two exciters, which may be operated either singly or in parallel on the excitation bus; also the motor and generator field switches and the reversing rheostat disconnecting switch. Each exciter is capable of supplying excitation to the complete propelling plant, thus leaving the other unit as a spare or as a source of power for auxiliaries. Above the main panel are two double throw switches, by means of which either main generator or either exciter may be connected to the auxiliary power bus. All switches and meters are plainly marked with suitable name plates, with white letters on black background.

After the main knife switches, field and exciter switches and circuit breaker have been closed, the operator has complete control of the maneuvering of the ship in the one main control hand wheel. The motor responds immediately to the movements of this hand wheel, and the complete operation of going from "full ahead" to "full astern" consists only in moving this hand wheel through 180 degrees. Since no circuits are opened, burning and consequent wearing of contacts, always present to a greater or less degree in other forms of control, are eliminated, which makes for reliability and low maintenance cost.

The reversing rheostat provides for 30 economical running speeds, equally apportioned between zero and the maximum, either ahead or astern. Also operation can be had from either main generator and both units of the motor at full power on the generator, in case one generating set is out of commission, or for a cruising speed. In this case, the motor field strength is reduced by the double rheostat, causing the motor to speed up, until full power is absorbed from the generator. The value of this arrangement for cruising is seen from the fact that the vessel will make a speed of 8.5 knots and has a cruising radius of 6,450 miles on one engine, while she makes a speed of 10.5 knots and has a cruising radius of 3,915 miles on both engines.

It is interesting to note that the same propeller and shafting as were used on the old steam engine drive were retained for the electric drive. Also very few alterations had to be made to accommodate the motor and generating sets. This is an example of how easily the steam driven ships may be converted into much more economical Diesel electric driven boats.

Trials

The equipment on the *Alcyone* operated to the satisfaction of all concerned on her trials. During her sea trials, a four hour full power run was made. The average propeller speed for this run was 160 revolutions per minute and the average boat speed 10.5 knots. The temperature of the machines at the end of the day's run, which included maneuvering in addition to the full power run, showed that considerable reserve capacity was available in the apparatus, if needed for emergency use. During the maneuvering trials it was demonstrated that the yacht could be stopped from full speed in less than double her length.

The *Alcyone* is the third schooner yacht to be equipped with this type of drive. The first two were the *Guinevere*, equipped with a 550-shaft horsepower drive, and the *Elfay* with a 90-shaft horsepower drive of the same type.

The engines of the *Alcyone* were made by the Winton Engine Works, Cleveland, O., while the electrical propelling equipment was built by the Westinghouse Electric & Manufacturing Company. The installation was made at the Tebo Yacht Basin of the Todd Shipbuilding and Dry Dock Corporation, under the supervision of Tams and King, naval architects, of New York.

The Reconstruction Hospital

ONE of the outcomes of the Great War has been an intelligent study of both the mechanical and therapeutic means of bringing maimed men back to physical health and usefulness. In this connection the ground has just been broken at 100th street and Central Park West, New York City, for a Reconstruction Hospital dedicated to the rehabilitation of men injured in the industries.

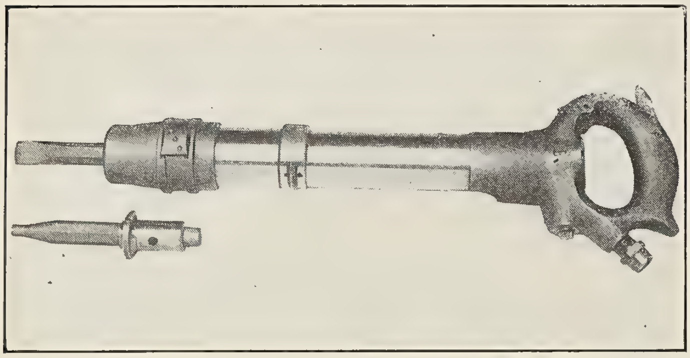
As seafaring men and shipyard workers are engaged in hazardous occupations where a physical disability disqualifies them from employment at their regular work, it is to the advantage of society as well as to the men who are crippled, to have a hospital where such restoration is made possible.

Seafaring men are particularly helpless when injured, as they often lack either the friends to help them or the knowledge of where to go to get aid. In the old days they were often seen limping around the waterfront, a burden to themselves and useless to the trade in which they had been trained. An institution devoted to the physical and mental restoration of men in such unfortunate circumstances can do a great deal of good.

Shipping Board Contract.—The Emergency Fleet Corporation has just entered into a contract with the Texas Company for the movement of between 500,000 and 1,000,000 cases of oil to East and South African ports. This movement will be based on monthly shipments and extend over a period of a year under the managing agency of the Mallory Transport Lines, Inc.

Pneumatic Tool for Removing Rivets

A pneumatic tool for removing rivets, known as the Thor No. 90-S rivet buster, has just been placed on the market by the Independent Pneumatic Tool Company, Chicago. This is a substantial tool, as shown in the illustration, being similar in design to the Thor riveting hammer. It can be operated by one man instead of three and used in close quarters. The tool is well adapted for cutting off and backing out rivets of all sizes.



Easily-Operated Thor Pneumatic Rivet Buster

The operation of this tool by one man instead of three results in a considerable labor saving. Rivets can also be cut in more difficult corners and there is less possibility of damaging the steel plates.

On account of the blows being rapid but not so severe the plates do not buckle at rivet holes, thus wasting expensive material as is often the case with the old style heavy three man buster. The Thor machine is designed to cut the rivet off smoothly at the surface of the sheet without disfiguring or spoiling the material.

The chisels and backing out punches are provided with individual safety retainers and can be quickly changed in the hammer from cutting off to backing out without disassembling the small retainer from the shank.

Auxiliary Steam Yacht Completes Cruise Around the World

THE former flagship *Aloha* of the New York Yacht Club, owned by Commodore Arthur Curtiss James of New York, has just completed a cruise around the world, arriving at Newport, R. I., on June 1. She began the long cruise from New York on September 15 last and followed the route through the Panama Canal to Honolulu, China, Japan, Philippine Islands, India, Java and Ceylon, and passed through the Suez Canal to Marseilles, France.

The last leg of the cruise from Marseilles was made over the northern route, a distance of 3,900 miles, in 22 days, which was considered a very creditable record in view of the bad weather encountered on the way across. The yacht behaved remarkably well on the entire trip and when she was docked at Newport showed practically no effects of her long voyage.

During the war the *Aloha* served in the Navy as the flagship of Rear-Admiral Cameron McR. Winslow. She was built for Commodore James in 1910 at the Fore River Plant, Quincy, Mass., of the Bethlehem Shipbuilding Corporation, Ltd., and is equipped with two watertube boilers and one triple expansion steam engine, with cylinders 12 inches, 19 inches and 30 inches diameter by 24 inches stroke for auxiliary power. The yacht is 218 feet 4 inches in length overall and 35 feet 5½ inches beam, molded.

The Aloha, Former Flagship of the New York Yacht Club, Which Has Just Completed a Voyage Around the World

Webb Institute Celebrates Annual Commencement

Distinguished Speakers Address Graduates—Advice Applies Equally Well to Those Who Are Learning by Experience

THE WEBB INSTITUTE, which is devoted exclusively to naval architecture and marine engineering, held its twenty-sixth annual commencement on June 10. In the absence of Commander Stevenson Taylor, president of the institution, who was in Europe at the time, Captain W. M. McFarland, vice president, acted as master of ceremonies.

Captain McFarland said it was a matter of great regret to him that Commander Taylor could not be there for he considered that the commander's work at the institute was of equal beneficence to that of Mr. William Henry Webb, its founder. Captain McFarland then read a cablegram from Commander Taylor which follows:

"I regret my absence from commencement today, the second time only since the first graduating exercises in 1897. My heart is with you all, trustees, officials, guests and students, particularly with those who now commence assuming responsibilities to which doubtless they look forward with pleasure. God speed them and bless all."
"STEVENSON TAYLOR."


Stevenson Taylor


Walter M. McFarland

THE CHAFFEY MEMORIAL PRIZE

Announcement was next made that the alumni had raised and presented to the Institute over $1,000.00, the interest on which was to be awarded annually to the student showing the highest degree of mental, moral and physical fitness. The prize this year was given to J. Byron Blood, who later read the valedictory address.

Captain McFarland concluded his remarks with the expression that it is a source of great satisfaction that a sound engineering education is a splendid foundation for a success in many fields and even though the present outlook in naval architecture and marine engineering is anything but bright and some of the graduates would probably have to enter other lines, he was confident that the passage of pending shipping legislation would encourage American citizens to build and operate vessels under the American flag.

A MAN TRAVELS BY HIS MIND

Commander Richard D. Gatewood, Director of the Division of Construction and Repair, United States Shipping Board, said in part:

"You gentlemen of the graduating class from this day forth start out to sea. Some of you actually will go out to sea. All of you, however, will start out upon that other sea of commercial life in which there are so many rocks, so many narrow shoal places, so many currents and so very few charts.

"We live by our visions, and the ambitious, the venturesome, the progressive among us, using the light of imagination and guided by reason and judgment, discern dim objects on the horizon of the sea of life toward which we feel impelled to move. But *then,* when we satisfy those desires, when we find the something greatly coveted, the horizon is still as far away as ever, and other shapes are always looming there calling our restless *minds.*

"It is for this that teachers have been training your *minds* these many careful years. They haven't trained your five physical senses, they've trained your *mind.* Surely you know that you cannot perceive absolute truth through the five senses. If men had tried to do that, the earth would still be flat, the sun would revolve around the earth and sink each night into the sea, the moon would be a silver disk in the sky a few inches in diameter. The greatest things of all, love and truth and duty and loyalty and courage, we can't know by our senses. We know them by our *mind.* The truth of the multiplication table is in no way dependent on our senses, is it?

"From today you will not travel any longer together, but let me ask you to be good travelers, to study the men you meet along the way and know that they must not be judged by their weaknesses, but rather by their power to lift their heads above others in time of stress and peril. Cultivate high ideals and hold fast to them whatever comes. Hold fast to the spirit of this Institute, hold fast to the spirit of the profession, the love of duty that is stronger than the love of life.

"Will you cultivate the art of traveling, the spirit of patient observation, the spirit of progress? I ask you because your careers will be watched with great interest. Word will come back here where you start. Will it be a good voyage you are about to make? *A man travels by his mind.*"

STICK-TO-IT-IVENESS

Mr. Alfred W. Kiddle, president of the Engineers' Club, stated that "the great thing in life is continuity of purpose founded, of course, on good conscience and directed by lofty ambition. Therefore, whatever particular field of endeavor within the great engineering profession, or indeed, in any of the other learned professions or in business, perhaps, that you may select in which to devote your faculties and your

labor, I enjoin upon you to determine for yourself as soon as may be possible a definite purpose or aim and rigidly adhere thereto, for work without an object leads to no achievement, and life without an aim is like a ship at sea without a port or destination.

Webb Appreciative Fund

Mr. Joseph Husson, president of Webb Alumni Association, spoke of a "quarter of a million dollar fund" that had been subscribed by the graduates in appreciation of a four-year education in naval architecture and marine engineering together with meals and room during the school term of those four years, absolutely without cost. Competitive examinations are held each year in September. The Webb Institute was endowed in 1891 and opened in 1895 by William H. Webb, one of New York's most famous shipbuilders in the days when American clippers ruled the seas.

Dolphin, Largest Diesel Yacht, Delivered to Owner

The Diesel cruising yacht *Dolphin,* built by the Newport News Shipbuilding & Dry Dock Company from designs of Cox & Stevens, New York naval architects, for Mortimer L. Schiff, was delivered to her owner on Saturday, June 3, having been only three months under construction. The *Dolphin* is claimed to be the largest Diesel motor yacht built in this country, being 180 feet in length, 24 feet beam, 14 feet depth of hold and equipped with two 500 horsepower Winton Diesel engines.

Maiden Voyage

The yacht left the builders' yard on Saturday morning, June 3 and arrived in New York harbor at two o'clock Sunday morning, her average speed from the capes to the lightship being 14½ knots without forcing the engines.

The *Dolphin* will be a notable addition to the yachting fleet as she is a sturdy craft with excellent sea-going qualities and accommodations that are most unusual both in the size and attractiveness of the various large rooms on deck as well as the living quarters for the owner and guests.

(Photograph by M. Rosenfeld, N. Y.)

Diesel-Engined Cruising Yacht Dolphin

Shipping Board Sells Diesel Engines.—The Material Sales Division of the United States Shipping Board Emergency Fleet Corporation has just consummated the sale of 2 McIntosh & Seymour 900 horsepower Diesel engines to the Munson Steamship Lines. It also has for sale the following Diesel engines: 2 Bolinder 320 horsepower; 1 McIntosh & Seymour 750 horsepower; 4 McIntosh & Seymour 750 horsepower; 8 Scandia Pacific Oil Engine Company 825 horsepower; 2 Scandia Pacific Oil Engine Company 825 horsepower; 2 McIntosh & Seymour 900 horsepower—1 right hand and 1 left hand.

Steamship Cynthiana Recently Built by Irvine's Shipbuilding and Dry Docks Company, Ltd., Middletown Shipyard, West Hartlepool, for Furness, Withy and Company, Liverpool

The vessel is of the shelter deck type, built to Lloyds' highest class, the dimensions being 435 feet 6 inches in length by 55 feet beam extreme by 30 feet 6 inches depth molded. She has three complete decks and a top-gallant forecastle, six hatches, grain divisions throughout, and water ballast in cellular double bottom, fore and after peaks and two large deep tanks, placed respectively forward of the boiler room and aft of the engine room. Propulsion is by a triple expansion engine with cylinders 29, 49 and 80 inches in diameter by 54 inches stroke supplied by Richardsons, Westgarth & Company, Ltd., Hartlepool. Steam is supplied at 180 pounds per square inch by four Scotch boilers working under Howden's forced draft and arranged for burning either coal or oil. On trial the vessel made a speed of 12½ knots.

Adjustments of the Compass

Causes of Deviation of the Compass and Methods of Compensation

By C. H. Peabody, Dr. Eng.

THE magnetic compass points more or less to the north; the angle which the needle makes with the true north, that is, the geographic north, is known as the variation. In the northern states and the North Atlantic the variation is to the east; it may amount to fifteen degrees. Charts showing the magnetic variation are issued by the United States Coast Survey, variations to the east being marked plus and those to the west minus. The navigator of a wooden ship, with no iron near the compass, needs only to allow for the variation in order to steer a true course. Thus, if the variation is 10 degrees east and if the true course is 55 degrees northeast, the navigator will give the steersman the magnetic course as N. 45 degrees E.; that is, the magnetic course will be northeast. This comes from the fact that the compass card has 32 points each equal to 11 1/4 degrees, the ship's course is then north four points east, which comes out northeast as given. But compass cards are now divided into degrees as well as points and the courses are commonly given in degrees. The latest naval practice is to divide the compass card into 360 degrees numbered from north right around by the east and south. Thus, S. 45 W. becomes 225 degrees.

In some localities the variation may be very large; for example, in northern Canada near Baffin's Bay the compass becomes very unreliable which adds to the difficulties of Arctic navigation.

Iron Must Be Kept Away from the Compass

It is very important that iron should be kept away from the compass on a wooden ship; if for any reason it is impossible to do this, then some adjustment of the compass may be necessary. Such adjustment is commonly simple, but being unusual may be perplexing even to a compass adjuster; reference to this matter will be made later.

But ships, and especially steamships, are likely to be built of steel which affects the compass variously and intelligent adjustment becomes necessary.

For steel ships the same precept holds, that steel and iron must be kept from the immediate neighborhood of the compass, so far as possible. It is well that the wheelhouse should be built of wood and no loose iron and, in particular, no magnets should be kept in the wheelhouse. The shafting leading to the steering engine (or to the rudder) should be made of composition. Even the quartermaster must be considered and not allowed to carry a large clasp knife or other iron or steel.

Magnetism of the Ship

All the steel delivered at the building slip is likely to be magnetic in some degree, and the processes of working the steel into the ship, especially hammering, develops magnetism, so that the ship in a sense becomes one huge magnet. But again, we must keep in mind that steel or iron near the compass has the greater influence; a steel cargo boom near a compass may have more effect than the smokestack at a distance; such a boom must be stowed in its supports when compasses are adjusted.

The navigating compass is often on deck or on the bridge in such place as is at once convenient for taking observations and as little influenced by magnetism as possible. On a steel ship no place entirely free from magnetism can be found, but there is always a choice.

The magnetism we are now considering is called "permanent magnetism," because it is not changed by moving the ship around, nor by sailing to a distant port. It is liable to decrease more or less slowly but that matter will be treated by itself.

The whole effect of permanent magnetism may be likened to that of two magnets at the level of the compass; one magnet may be taken as fore-and-aft; that is, either forward or abaft of the compass; the other magnet may be taken as athwartship; that is, either to port or starboard. The permanent magnetism of the ship may consequently be compensated by two magnets that can be adjusted near the compass.

Compensation of Ship's Magnetism

An evident way of compensation is by the use of large bar magnets which are soldered up in copper cases to avoid corrosion. Now the north end of the compass needle is that which points to the north; and any magnet may have its similar end marked *N* or north. To test a magnet bring one end near the compass; its north end repels the north end of the compass needle. Sometimes the magnet or its case is painted red at the north end and blue at the south end. We have for a reminder that *r* is found in "north" and in "red," while *u* is found in "south" and in "blue."

Fig. 1

In all cases, powerful magnets or other magnetic material should be brought near magnets only by intention and deliberately; "near" in this case means near enough to give intended effect and not "nearer."

Suppose that the ship has been brought on a correct magnetic north and south course, as shown by Fig. 1; and that the compass needle makes an angle with that course, which angle is known as the deviation of the compass. A bar magnet may be laid down athwartship as shown with the north end to the starboard; it will tend to correct the deviation and it can be moved toward the compass until the deviation disappears. This operation will correct the athwartship magnetism of the ship.

The ship may then be brought to a correct east and west magnetic course, as shown by Fig. 2. A fore-and-aft magnet

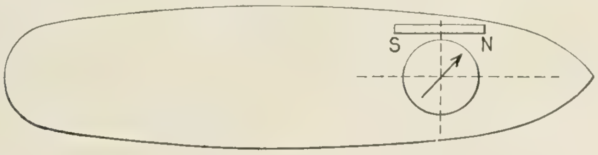


Fig. 2

may be laid down and brought up toward the compass until it corrects the fore-and-aft magnetism of the ship.

Semi-Circular Deviations

The deviations just discussed are known as semi-circular deviations. To explain this term let us admit that the fore-

and-aft magnetism could be represented by a single long magnet forward of the compass with its south end up and the north end at a long distance below. This south end will act as a single point of attraction to the north end of the needle, as shown in Fig. 3, and it will draw the needle toward the east, producing a deviation. If the action begins with the magnet *S* in the north and south line, no deviation will be produced. As the magnet is carried around, the deviation will increase until the magnet is nearly but not quite east of the compass. Going on, the deviation will decrease until it disappears when the magnet is south of the compass. A semi-circular motion thus produces a complete cycle of deviation; the other half circular motion from south to north will produce a similar cycle of deviation to the west. A similar action takes place when a ship swings all the way around from north to east, to south and then to west and north.

Fig. 3

Bar magnets may be placed forward or aft of the compass or on either side; or both forward and aft or on both sides. Some binnacles are four sided with facilities for fixing as many bars as may be needed. The Ritchie compasses have fore-and-aft and transverse trays in the binnacle, into which magnets can be laid in the proper number; the trays can be raised or lowered to complete the adjustment. The Kelvin compass has small bar magnets in the compass bowl, with screws for adjusting them. In any case the method is essentially the same. The methods all are tentative and any error can be at once detected and corrected.

Quadrantal Deviation

Thus far we have been dealing with permanent magnetism which changes slowly, if at all; but any soft iron bar which lies in a north and south direction immediately acquires magnetism, and it loses it progressively as it swings round toward the east or west. When such a bar lies in the line of the compass needle it has its maximum magnetism, but it does not deflect the needle. When it swings to the east, the south end draws the needle and gives it an easterly deflection which becomes a maximum at about 45 degrees; the magnetic effect

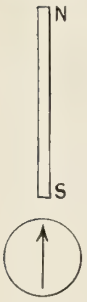


Fig. 4

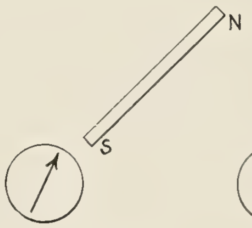


Fig. 5

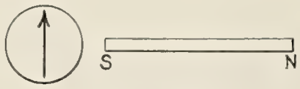


Fig. 6

decreases to zero as the bar swings so as to lie directly east as shown in Fig. 6; it then produces no deviation. As the bar swings toward the southeast the end near the compass acquires north magnetism which draws the south end of the needle to the east and produces a westerly deviation of the north end of the needle. Going on, the bar produces an easterly deviation when it lies southwest of the compass, and a westerly deviation when it lies northwest of the compass. This deviation, due to horizontal iron, is called quadrantal deviation.

Magnetic Effect of Ship's Deck Beams

If two bars are fastened to a frame at right angles with each other they will tend to counteract each other's effect. The more powerful bar will produce quadrantal deviation of its own kind but the deviation will be less. Any system of bars at right angles will in like manner give a resultant effect. The effect of any bar will depend on its length and size and on its proximity to the compass. The deck beams beneath a compass usually have the dominant effect. If a ship heads to the northeast, the deck beams will lie as shown in Fig. 8 and will produce an easterly resultant quadrantal deviation. The compensation is made by cast iron balls set in slots in a bar carried athwartship on the binnacle as indicated by Fig. 9. These balls have north magnetism at the north hemisphere and south magnetism at the south hemisphere however they may lie; this has been indicated by hatching the southern hemisphere; the actual balls are painted one color and give no such an indication. In Fig. 9 the balls have no resultant influence on the compass needle because individually they have equal and contrary influence. As the ship swings to the east the port ball, presenting its southern hemisphere to the compass, tends to draw the head of the needle to the west, and the starboard ball presents its north hemisphere and has a similar effect on the south end of the needle. This influence increases with the angle until it reaches a maximum when the ship heads to the northeast as indicated by Fig. 10. The balls thus have a quadrantal effect contrary to that of the beams as shown in Fig. 8.

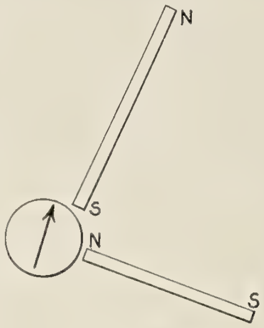


Fig. 7

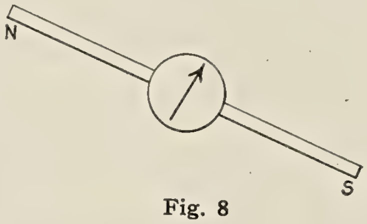


Fig. 8


Fig. 9

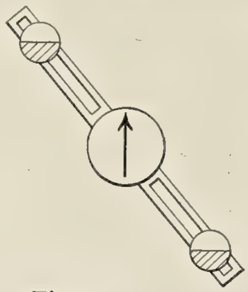


Fig. 10

Correcting Quadrantal Deviation

The quadrantal deviation is corrected after the semicircular deviation has been completed. The ship is put on a quarter bearing, for example it may head northeast; the compensating balls are put in the outer ends of the slots and are moved toward the compass until the quadrantal deviation disappears.

Actual Compensation of a Ship's Compass

To recapitulate: the ship is put on a principal bearing, such as north, as shown by Fig. 1, and a magnet is placed to correct the deviation then shown; the ship is turned through 90 degrees as shown by Fig. 2 on an easterly bearing and another magnet is placed to correct the deviation on that bearing; this completes the compensation for permanent magnetism. The ship is then put on a quarter bearing, as

shown by Fig. 10 and the quadrantal deviation shown is compensated by the balls.

In practice it is customary to test each compensation by reversing the course of the ship. For example, beginning on a northerly bearing and correcting the deviation as directed, the ship is immediately swung through a half circle and put on a southerly bearing; if there is no deviation on this southerly course, that step is complete. But, if there remains a small deviation on this southerly course, it must be reduced.

The first step is to see if the pin on which the needle is supported is eccentric; if so, it should be corrected; usually this point is looked after before the compensation is undertaken. If there is a deviation when the needle is known to be straight and when the compass card is concentric with the compass bowl, the custom is to correct half of it by moving the proper magnet. The ship is then turned around to a north bearing and an observation is made to see if there may be a deviation on that bearing. Perhaps there may be equal and contrary residual deviations on the opposite bearings; in such case the deviation must be recorded and allowed for in the navigation of the ship.

In like manner, if the ship is set and compensated on an easterly bearing, it is swung round to a westerly bearing and the residual deviation is divided between east and west bearings should there be any left. So also after the quadrantal deviation has been made on a quarter bearing, say N. E., the ship is swung round in succession to S. E., S. W. and N. W. to test the compensation; should there remain deviations on some or all of these points an attempt may be made to distribute the deviation; such a distribution is likely to be made only when the quadrantal deviation is very large.

The magnetic influence of horizontal soft iron is greatest near the equator and decreases toward the poles; but as the corrective influence of the balls varies in like manner an adjustment of quadrantal deviation at any latitude should be good for any other location.

It is customary to cast the arms for the quadrantal balls athwartship onto the binnacle for compasses of merchant ships. Warships sometimes have the arms given a little freedom so that they may be given a small angle with an athwartship line. This is to make it possible to refine the compensation and allow for the effect of diagonal members that may come near the compass. Such compensation is not conveniently made by the process here described and no further attention will be given to it.

Magnetic Effect of Vertical Soft Iron

Near the equator vertical soft iron has little or no magnetic influence, but as a ship goes north the vertical iron has greater and greater influence. In the northern hemisphere the lower end of a vertical bar has north magnetism; in the southern hemisphere this is reversed and the magnetism becomes south at the lower end. At any place the magnetism of a vertical bar remains constant and cannot readily be distinguished from permanent magnetism.

In our discussion of semi-circular deviation the effect of vertical iron has been ignored; in effect it has been allowed to go in with the effect of permanent magnetism. If a ship's service is in the middle latitudes of one hemisphere, this practice leads to no difficulty but, if the ship sails to the equator and yet more if she sails to another hemisphere, there should be a separate correction for vertical soft iron.

Compensating Magnetism of Vertical Iron

Commonly a compass is placed amidships and the structure of the ship is symmetrically arranged port and starboard, so that the effect of all the vertical iron is equivalent to that of a single bar on the ship's axis. The resultant effect of vertical iron on a compass in the wheel house is like that of a bar abaft the compass with its upper end on a level with the compass. A compensation can therefore be made by placing a proper bar directly forward of the compass; perhaps on the wall of the wheelhouse. This bar is known as Flinders' bar, named for Captain Flinders of the Royal Navy, who first detected and corrected deviation on certain wooden naval vessels which had iron pillars under the deck beams.

The convenient way of setting Flinders' bar is to wait till the ship comes into port at or near the magnetic meridian, which is located on magnetic charts. An investigation will show that the fore-and-aft compensation of the ship is overdone; that is, the ship on an east or west bearing will show a deviation contrary to that found on such a bearing when the ship was compensated. This deviation can be released by moving back the proper magnet from the compass. The number of degrees may be recorded for action after the ship returns to the home port or to a like latitude. After the return the ship will show a residual deviation on an east or west bearing. A proper soft iron vertical bar may be placed forward (or aft) of the compass to correct this residual deviation. A convenient way is to use a bundle of small rods and add or take away rods till the compensation is complete. When once this compensation has been made it will remain permanently.

It is not necessary to return to the home port to set Flinders' bar. At any port the compass may be taken ashore to some place free from local magnetism. The compass may be set so that the needle reads north; then a bar of soft iron may be brought near to a position such as it will conveniently occupy aboard, and the adjustment may be made by causing a deviation equal to that found aboard but in the contrary direction.

Influence of Iron Below the Compass

There now remains the consideration of the influence of iron or steel below the level of the compass. The resultant influence may be likened to that of a vertical magnet directly under the pin on which the needle is supported. When the ship is in quiet water such a bar cannot produce deviation; but when the ship rolls such a bar would swing from side to side and might give a trivial deviation. Should the time of swinging of the compass needle and its card be the same as the time of rolling of the ship, a troublesome oscillation of the card might be set up. To obviate this difficulty it is customary to provide a vertical permanent magnet under the compass that can be raised or lowered by a chain or other device. When the ship is rolling and the card is oscillating the magnet may be raised or lowered until the trouble disappears. Sometimes such a magnet may be found to be upside down, in which case it is reversed in order to make the compensation.

How to Prepare a Chart of Residual Deviations

After a ship's compasses have been compensated for semicircular and quadrantal deviations, with or without Flinders' bar and the vertical magnet just mentioned, it is customary to swing ship and prepare a chart of residual deviations.

The ship is brought in succession to regularly distributed bearings; there should be at least eight and preferably sixteen such bearings. If convenient, each of the 32 points of the compass may be used. The ship should be held two or three minutes on any bearing and then the true magnetic bearing should be determined and the reading of the compass taken; this is to allow for the lag of the compass, which is slow in coming to a fixed reading.

It is desirable to place the ship exactly on the desired true magnetic bearings and read the accompanying deviations; it is then easy to make a table of correct and compass bearings for each point of the compass so that the navigator may readily give compass bearings to the steersman, or may make proper correction to his observations. But, if the ship is brought near the proper bearings, a diagram may be made

from which a table can be interpolated; or the interpolation can be made arithmetically.

Usually, when compensation has been skilfully made the residual deviations are small and are easily allowed for. If the deviations are large and especially if they are irregular, the compensation should be repeated.

The construction and use of compass diagrams cannot conveniently be represented in this article; details may be sought in text-books.

Loss of Magnetism

Thus far we have considered that steel has permanent magnetism; but hard steel bars that are specially magnetized are liable to lose magnetism slowly even if provided with keepers. The steel worked into a ship is magnetized by hammering and other work done on it; the amount and kind of magnetism depend both on the amount of work and the direction in which the ship lies on the building slip. When possible the ship should lie in a contrary direction in the fitting slip; the work of fitting may then relieve some of the magnetism.

After the ship has gone into service the magnetism slowly decreases and the movements among waves at sea help along that effect. Ships are likely to have their compasses over adjusted after some time in service; the navigator should have this in mind to avoid inconvenience or even disaster. The magnetism so lost in service is known as sub-permanent magnetism.

Retentive Magnetism

If a ship lies in an approximate north and south position in port for several days, it is likely to acquire retentive magnetism amounting in some cases to two or three degrees. The captain of a certain ship coming out of Baltimore was accustomed to make an allowance for such retentive magnetism when coming out. Such an error might easily lead to grounding of the ship, if uncorrected. After some hours at sea retentive magnetism may entirely disappear. Retentive magnetism may be detected by taking the bearing of some convenient point on arrival at the dock and again just before sailing; any change is likely to be due to that cause.

It has been tacitly assumed that a ship may readily be placed on any magnetic bearing or any desired succession of bearings; the methods of accomplishing such a purpose have been purposely reserved for consideration to avoid confusing the obvious methods of compensation with the detail that may now be stated separately. There are several methods that may be employed as convenient.

Methods of Placing a Ship on Magnetic Bearings

At some docks magnetic bearings are marked by lines painted on adjacent buildings or by some other method. Such a device is more convenient for checking the condition of compasses than for making compensation.

If a ship at anchor swings entirely round with the tide, or if it can readily be made to swing round, opportunity can be taken to compensate the compasses or to note and record residual deviations. The inconvenience is that it takes a considerable time and that the swinging is irregular and may be too rapid at certain stages of the tide. The swinging may be controlled in part by springs on the cable.

A very convenient way of locating the various magnetic bearings, such as north, east, etc., is by taking bearings of some distant object such as a church steeple or any easily identified point, for which the true magnetic bearing may be known or can be obtained. Bearings can be taken by aid of a metallic ring that fits on the compass bowl and carries sight vanes. The sight vanes may have simple vertical slots or there may be one slot to peep through and a wire in a wide slot to aid in setting on the object in question. The object chosen must be far enough off so that the bearing will not be sensibly changed by the swinging of the ship; four or five miles is usually enough. If the bearing is unknown it may in some cases be found by sending a compass ashore and placing it so that it, the ship and the steeple (for example) are in one line. If the water is very quiet, it may be possible to get the bearing by aid of a compass in a small boat that can be placed in line with the ship and the steeple. Or, if the ship swings completely round and if bearings are taken at regular angular intervals, the true magnetic bearing can be found by taking the algebraic sum of all the apparent bearings.

Reciprocal Bearings

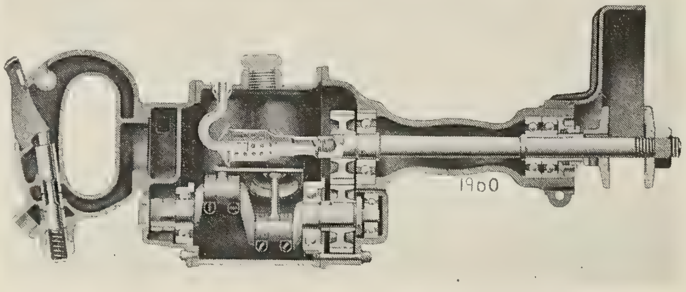
If it is convenient to send a compass ashore, the method of reciprocal bearings will be found rapid and easy. An observer aboard may take a bearing of the compass ashore and at the same time an observer at the shore compass may take a bearing of the compass on the ship. The shore compass should be free from local magnetic effect and will give a true bearing, which is opposite to the true bearing from the ship. Suppose the shore compass gives S. W. for the bearing of the ship compass; the true bearing of the shore compass will be N. E., or N. 45 degrees E.; suppose the observer aboard reads the bearing N. 50 degrees E., there then will be an easterly deviation of 5 degrees. It may be convenient to employ a tug to push the ship around; the tug, and especially its smokestaff, is liable to have magnetic effect and must be kept away from the compass under observation.

The most common way is to take the ship outside the harbor and steam it around onto desired bearings which are identified by taking observations on the sun. The observation most conveniently made is the altitude of the sun above the horizon by aid of a sextant; but by aid of prepared tables the azimuth of the sun can be taken or interpolated for the date and hour of the day. By the azimuth of the sun we mean its angular distance from the true or geographic north. Allowing for the magnetic variation the correct magnetic bearing can readily be identified, to which the ship may be brought by steaming around slowly. The idea is simple enough, but the application together with the use of tables may be best learned from a competent compass adjuster.

This article has purposely been written in a sketchy manner to avoid complexity and garrulity. Perhaps the reader may be able to make the compensation of a compass under simple conditions, perhaps it may aid in understanding compensations as made by an expert or perhaps it may lead to reading more ambitious presentations of this important and interesting matter.

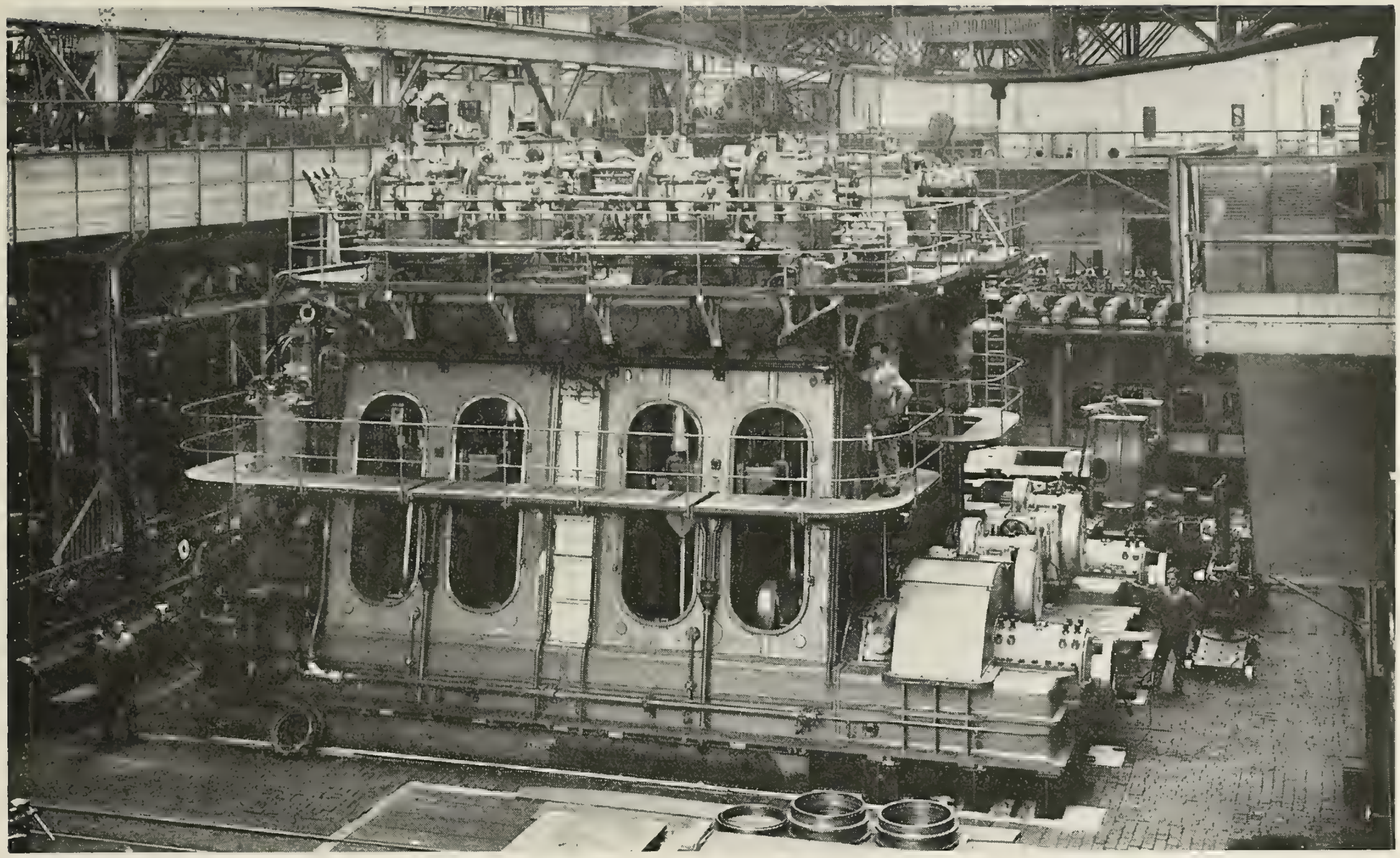
Oil Separator for Air Grinders

To permit air grinders to operate for long periods without replenishing the supply of lubricant, the Chicago Pneumatic Tool Company, Chicago, Illinois, has designed an oil separator which is applicable to "Little Giant" air grinders.



Oil Separator Applied to "Little Giant" Air Grinder

The oil separator consists of a hollow perforated cylindrical steel shell attached at one end to the grinder spindle while the other encircles and revolves around the vent tube.



Two 2,000 Brake Horsepower Sulzer Diesel Engines Erected in the Builders' Shop Preparatory to Installation in a 11,500-Ton Ship

Four Cylinder Two Cycle Sulzer Engine

Designed to Develop 2,000 Brake Horsepower at 100 Revolutions Per Minute—Turbo Scavenging Pumps Used

By Our Special London Correspondent

SHIPOWNERS, recognizing the advantages of motorships over steamers in present circumstances, are continually demanding of the builders that oil engines with higher powers should be developed. In addition there is a more general request for single screw ships which the average shipowner prefers, at any rate in moderate powers. Two main tendencies are therefore to be noted in European marine engine design: first, the production of motors with larger specific cylinder output, and secondly, the construction of slow running and consequently long stroke engines specially adapted for the slow speed of propeller rotation required in these vessels for maximum efficiency.

The greatest advance in the development of high powered engines has been made by Doxfords, whose four cylinder opposed piston engine with cylinders 580 millimeters bore and stroke of 1,160 millimeters now develops approximately 4,000 indicated horsepower or 1,000 indicated horsepower per cylinder. This is essentially a motor for installation in single screw ships running as it does at 77 revolutions per minute. Not to be outdone in this direction, the builders of four cycle engines are showing similar activity. Burmeister and Wain, which has already standardized a 3,200 indicated horsepower eight cylinder set running at 115 revolutions per minute for twin screw vessels, has now produced a long stroke design running at 85 revolutions per minute for single screw ships. An order has just been placed for the largest engine of this type yet constructed which will develop 3,200 indicated horsepower but at the lower speed of revolution.

New Sulzer Developments

Sulzer Bros. is also progressing along the same lines and has just completed the two largest sets of the single piston two stroke type which have yet been built for marine work. An illustration of these engines erected on the test bed is given and they will shortly be installed in the 11,500 ton motorship *Camramh* now under construction for a well known French shipowning firm, the Chargeurs Reunis.

A still larger set developing 3,500 brake horsepower in six cylinders is under construction, the diameter of the cylinders being about 36 inches and the stroke just under 48 inches. This latter engine is for installation in a large ship for the North German Lloyds and it is an indication of the ideas of the designers that plans for the construction of a 5,400 brake horsepower six cylinder Sulzer engine have been prepared. Two of these sets will shortly be laid down for installation in a large liner and it may be noted that the cylinder diameter is 900 millimeters and the stroke 1,550 millimeters—dimensions far in excess of any that have yet been used. It may be added that the overall length is 63 feet and the total height 25 feet.

Returning to the 2,000 brake horsepower engines, these are designed to run at 100 revolutions per minute developing

1,700 brake horsepower at 85 revolutions per minute. The cylinders have a bore and stroke of 680 millimeters and 1,200 millimeters, respectively, and it will be noted that the scavenging pumps are not direct coupled. Sulzers have in fact now standardized a system for all engines over about 1,000 brake horsepower by which the scavenging air is supplied from separate electrically driven turbo scavenging pumps. The object of this arrangement is to give additional shaft horsepower for given cylinder dimensions, while there is a slight reduction in weight and the designers consider that the method is generally more convenient. A small saving in overall length is also effected. A single three stage air compressor is driven at the forward end of the engine while at the same end are lubricating oil and circulating water pumps.

Cast Iron Framing Supports Cylinders

Although originally Sulzers adopted the steel column construction for supporting the cylinders and this has later been taken up by numerous Diesel engine builders, it is not used in the latest Sulzer motor. The cylinders are supported on heavy cast iron framing with large doors on the front which are removed in the illustration showing that easy access is available to the crank chamber.

The usual Sulzer system of port scavenging with a super charge of scavenging air admitted via a camshaft controlled valve through a series of auxiliary ports above the main scavenging ports is employed, which the makers claim enables them to maintain a high thermal efficiency; this seems to be borne out by the fact that on trials a fuel consumption of 0.398 pound per brake horsepower hour was attained.

Single Valve Cage in Cylinder Head

In each cylinder cover are arranged the fuel inlet, the starting and the relief valves. By a very neat design, these are all incorporated in one cage, so that only one hole has to be bored centrally in the cover, allowing a very strong construction to be adopted with ample and unrestricted cooling passages. A peculiarity of the engine is that the controls for maneuvering and reversing are located at the top of the cylinders although this is of course not essential. The builders, however, consider it advantageous since most of the running gear is located at this level.

Reversing is carried out by the provision of two cams and rollers for each fuel and starting valve respectively, the ahead cams being brought in contact with their rollers or the astern cams with the astern rollers as desired by the operation of the control levers.

A refinement of some value on high powered Diesel engines is the control of the amount of injection air admitted to the fuel valves at varying speeds.

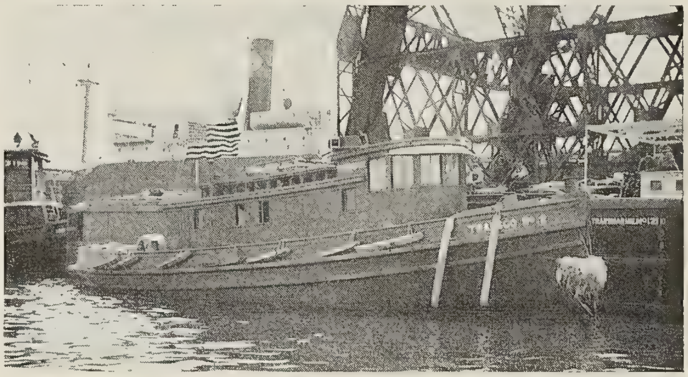
Diesel-Engined Tug for New York Barge Canal Proves Economical

With the completion of the *Transco No. 2,* the first of three Diesel-engined tugs to be placed in service this year on the New York State Barge Canal by the Transmarine Corporation, an opportunity is given to compare the relative advantages of Diesel-engined and steam driven tugs.

The *Transco No. 2,* which was built by the C. Hiltebrant Dry Dock Company, Port Ewen, New York, is 67 feet 6 inches long and 17 feet 6 inches beam. Propulsion is by a heavy duty, four cycle, reversing gear type, Nelseco Diesel engine supplied by the New London Ship and Engine Company, Groton, Conn. The engine has eight working cylinders, 9 inches diameter and 12½ inches stroke, and develops 240 horsepower at 350 revolutions per minute.

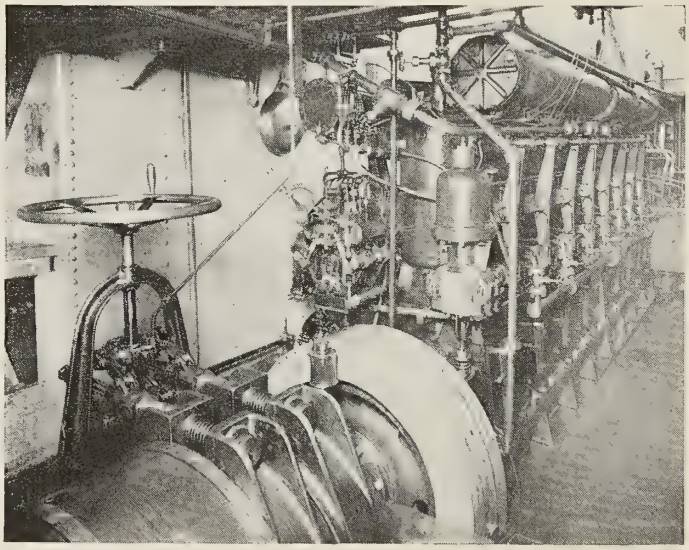
Trials of the vessel were conducted on May 14, consisting of a run on the Hudson River from Kingston to Albany where she was to enter the service of the Transmarine Line. On this run a speed of 11.3 miles per hour was attained on an average fuel oil consumption of 10½ gallons per hour and an average lubricating oil consumption of 0.45 gallon per hour.

On May 16 the vessel took a tow of five barges at Albany and proceeded up the canal. Meeting an eastbound tow at Little Falls, the tugs were changed and the *Transco No. 2,* taking the eastbound fleet, arrived at Pier 6, East River, New York, about 6:00 P. M. on May 23. A day later she left New York with a tow of five barges bound for Buffalo.



New York Barge Canal Tug Fitted with Diesel Type Propelling Engine

On steam tugs of the size suitable for use on the canal, it is necessary to stop for fuel about once every 24 hours. On actual test it was found that the cost of fuel for operating the *Transco No. 2* with her tow averages about 60 cents per hour; while steam tugs of similar horsepower, with the cost of coal at the present price, runs about $4.00 per hour. The time saved by avoiding the frequent stops for taking fuel and disposing of ashes is considerable and the fact that the tug is ready for operation at full load in one minute after word is given are features of great importance as well as the fact that no time is lost due to low steam pressure when cleaning fires.



240 Horsepower Nelseco Diesel Type Engine on Tug Transco No. 2

With this type of Diesel-engined tug, operating at something like 15 percent of the fuel expense of a steam tug and with approximately 250 percent more power available than in the steam tug, not only can higher towing speeds be obtained but also the barge fleets can be more effectively controlled when maneuvering.

System in Shipbuilding

By O. D. Treiber*

This article describes a method of controlling the productive elements in a shipyard where, due to the many varieties of work performed, an intelligent and practical system of management is of the utmost importance.

IT is no easy matter to control the activities in a large shipyard in such a manner that an adequate return in production is secured for the money paid to about forty-five classes of workmen which make up the twenty-five to thirty departments comprising a modern plant.

Such a control is highly essential, however, in order that the thousands of operations necessary to the construction of a modern ship may be properly coordinated with a view to attaining the maximum efficiency. Proper control is also desirable as a means of following the progress of the work at all times, thus insuring its completion within a time allotted and permitting the preparation of an accurate financial statement at any time or stage of the construction period.

The shipyard in which the work has been systematized to accomplish the above results in a sound, practical manner is conducting its business on a solid basis and is undoubtedly assured of steady work regardless of how keen competition may become.

The following system was developed by the author and successfully applied in the administration of a yard in which ships aggregating a total cost of ninety million dollars were constructed.

In developing this system the aim was to devise a method of control which would be simple and effective, which would be economical in installation and operation, flexible enough to expand and contract with the business in hand without confusion and which could be gradually introduced in an established yard without disrupting the organization or work under way during the time of its inauguration.

Principal Plant Divisions

Under the system of administration hereinafter described, the plant is divided into four principal divisions known as the sales, accounting, material and production divisions. In view of the fact that this article is intended to deal principally with the production problems met with, the sales and accounting divisions are not discussed and the material division, which has such an influence on production, is taken up only in so far as its functions affect the production division.

Organization

As the organization of a plant is usually built to suit the ability and capacity of the executive and departmental heads, to which is entrusted the carrying out of the firm's policies, no fixed rule can be established which will be applicable to all cases.

The system which follows, however, is such that it may be applied to any form of organization.

Of great value, in any event, is the construction of an organization chart defining graphically the duties, authority and responsibility of all executives, department heads, foremen and assistant foremen. A chart of this nature will insure that every person in the organization knows to whom and for what he and all others are responsible and will prevent the overlapping of authority which is so often the cause of many operations being neglected because of no definitely placed responsibility. By this means a great deal of misunderstanding and shifting of responsibility, with attendant confusion, is eliminated and a great deal of the trouble that makes systematic production difficult avoided.

Material Division

The material division is charged with the purchase and follow up of all material, receiving, storing and disbursing, material ledger accounts and the adjustment of excessive, deficient and damaged material accounts. It should be supervised by one man who has no other responsibility and can give his entire time and thought to perfecting his organization so that it will function correctly and efficiently.

The activities of the material division are divided among several departments, as follows:

A purchasing department which places the orders for all material.

A follow-up department charged with taking care of deliveries, cancellations and replacements, changes in routing and the adjustments of differences in material accounts.

A receiving department which receives all material and dispatches it to the proper store, checking the material delivered against the invoice and purchase order and reporting any discrepancies to the ledger and follow-up departments.

A store department which is responsible for the proper storage and care of material and also for its delivery to the production division when required.

A ledger department which is held strictly accountable at all times for records showing the status of material ordered, the kind, grade, size and quantity of material on hand, where it is stored and what portion is reserved, with specific information relative to the job for which such portion is reserved and the date it will be required.

The ledger department is the principal department in this division. It is the only place from which material is issued to the workmen or from which information about material may be obtained. The ledgers should be kept in one office centrally located in the plant and there should be a ledger for each class of material. The system is such that this work can be done by one man or divided among a number, determined by the volume of business in hand.

Procedure Followed in the Material Division

Bills of material are prepared in the drawing office and sent to the planning department where notations are made against each item stating whether it is to be made in the plant or purchased already finished and the date it will be required. These bills of material are then sent to the ledger department of the material division where each item is checked in the ledgers. If the material is found to be on hand it is so indicated on the bill of material in a column provided for that purpose and a note made in the ledger that the material is reserved, giving the bill of material number, job number, amount required and the date it will be needed by the production division. If the material is to be purchased it is so indicated on the bill of material and is posted in the ledger as material to be purchased, notation also being made showing the bill of material number, job number, amount and the date required. These bills of material are then blueprinted and copies sent to the purchasing department, receiving department and to all the departments in the production division that will be concerned.

*Naval architect and shipbuilder of Alameda, Cal.

	DEPARTMENTS	Mon. 8/2	Tue. 8/3	Wed. 8/4	Thu. 8/5	Fri. 8/6	Sat. 8/7	Mon. 8/9	Tue. 8/10	Wed. 8/11	Thu. 8/12	Fr
1	Ship Fitters											
2	Shipwrights											
3	Ship Carpenters											
4	Joiners											
5	Painters											
6	Bolter Ups											
7	Drillers and Reamers											
8	Riveters (Complete Gangs)											
9	Chippers and Calkers											
10	Packers											
11	Tank Testers (Complete Gang)											
12	Cleaners											
13	Ship Riggers											
14	Electricians											
15	Machinists (Outside)											
16	Pipe Fitters (Including Shop)											
17	Copper Smith (Including Shop)											
18	Sheet Metal (Including Shop)											
19	Pipe Coverers											
20	Brick Layers											
21	Tile Setters											
22	Plate Hangers											
23	Yard Riggers											
24	Cork Insulators											
25	Trial Crew											
26	Machine Shop (Items only)											
27	Boiler Shop (Items only)											
28	Forge Shop (Items only)											

Fig. 1

The purchasing department places purchase orders for the items specified in the bills of material. The dates that the materials will be required, which are noted on the bill of material, are guides for placing orders so that such material will be available when needed and at the same time guarding against the accumulation of material in the plant that will not be needed for a long time and tying up capital with a possibility of loss through depreciation in value. Copies of purchase orders are sent to the ledger department and receiving department. At the ledger department the purchase order number, date it was placed and the date the material should arrive are posted in the ledgers.

The purchase order is then placed in a calendar file so that it will be brought automatically to the attention of the follow-up department in order to insure prompt deliveries.

Should the follow-up department engage in correspondence relative to material ordered, copies of such correspondence are given an identification number and placed in active file. The identification number is entered in the ledger and on the purchase order in the calendar file, so that complete information regarding material is available at all times from the ledger or the calendar file.

Material arriving at the plant is received by the receiving department, where it is checked against the invoice and the purchase order. Any differences between the invoice or purchase order and the material received are reported to the ledger and the follow-up departments for action.

The material is then dispatched to the proper sectional store and the invoice and purchase order sent to the ledger department where the receipt of the material is posted in the ledger with the place of storage. If the material checks with the invoice and purchase order, the ledger clerk removes the purchase order from the calendar file and the correspondence from the active file and places them in an inactive file for future reference should occasion require. The purchase order and invoice, which the receiving department used for checking the material, are then dispatched by the ledger department to the accounting department for payment.

Store orders are made in quadruplicate by the production division. One copy is retained by them and the other three are sent to the ledger department where the items are looked up in the ledgers to ascertain whether the material is on hand and, if so, in which store it is located. This location is indicated on the three copies by the ledger man who signs them, keeps one copy and sends the other two to the proper store where the order is filled. The storekeeper delivers the material and secures the signature, on these two orders, of the party receiving it. He then signs them himself and sends one copy to the ledger department, keeping the other as his order and receipt for the delivery of the material. The ledger clerk checks this returned copy with the one kept by him when he first endorsed the order and after checking off the material in the ledger sends the store order to the accounting department.

SHOP FINISHED ITEMS NO. ......

Date Required ....

Drawing No.............................. B. M. No..............................

When Finished Send to..............................

DESCRIPTION

....

....

....

....

....

....

....

....

....

....

....

....

O. K. ....
Planner

NOTE—Send this card to the planning department when the item is finished.

Fig. 2

This system of issuing material entails a minimum of routine and at the same time prevents material being checked out of the ledgers until it has actually been delivered and receipted for. It also permits any disputes, mistakes or irregularities to be quickly and accurately traced.

Production Division

The production division includes the planning department, drawing office, all shops and crafts, power, maintenance, extensions and betterments, tools, machinery and equipment, employment and welfare; in fact this division includes all the activities in the plant which contribute to production except those in the material division as outlined in the paragraphs above.

The greatest losses occur in a plant from labor inefficiency caused, in a large measure, by incompetent foremen, lack of

SHOP CARD NO. ......

Machine, Group or Dep't..........

Dr. No.......... B. M. No..........

Pattern No.......... Material..........

Starting Time.......... Finishing Time..........

Name and Number..........

INSTRUCTIONS and Operations	Feed Amt.	Speed Amt.	Time Req.
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....

SKETCH

Total Time..........

No. Pieces..........

Total Time..........

Rate..........

Amount..........

When Finished Send to..........

Signed.........., Rate Setter

Fig. 3

JOB CARD NO.........

Dept. .... Foreman ....

Starting Time.......... Finishing Time..........

Time Actually Started (PUNCH)..........

Time Actually Completed (PUNCH)..........

No. Men Required.......... Time Required.......... Total Hours..........

Total Amount.......... Ratios..........

No. of Pieces.......... Rate..........

Dr. No.......... B. M. No.......... Shift..........

Hull No.......... Charge No..........

INSTRUCTIONS

....

Assigned to.......... Number..........

....

Complete and O. K.

Foreman..........

Fig. 4

material, lack of inter-departmental coöperation, unbalanced department organization and indifference on the part of the workmen, due to lack of definite instructions as to what to do, when to do it and how to do it.

Responsibilities are also very often assigned to foremen for work which should not properly come within their jurisdiction and which it is impossible for them to supervise efficiently. The following method of administration is designed to overcome these losses with a view to maintaining harmony and efficiency in the plant.

Planning Department

All the activities throughout the plant which involve direct labor expense are directed, scheduled, rated, coordinated and controlled by the planning department which determines in advance when and how every operation that contributes to the production of a vessel will be done. This department is by far the most important one of all those in the production division.

In about the same manner that the detail plans for a design are prepared and made to coincide in the drafting room, so is the construction planned in the planning department, with a view to coordinating the work in all departments and insuring orderly progress.

This planning is done for all departments in one office, centrally located, by men who are rated as departmental executives. Their work actually directs and controls production. They are therefore held responsible for the efficiency of their respective departments and their authority is in keeping with this responsibility.

Special Equipment for Planning Office

To facilitate the work of the planning office a card rack is provided which is known as a calendar file. It is made as shown in Fig. 1 with pockets to take cards such as shown in Figs. 2, 3 and 4. These pockets are made in sections of six in a row, arranged to fit in slides on a large frame. The sections may be removed from the slides at the left and inserted again at the right, moving all sections to the left when one is taken out. Each vertical row of pockets is for one day and each section for one week, consequently there is one section to be removed each week. There should be twelve to fifteen sections representing that many weeks, but in some cases more sections will be of benefit. Vertically the rows are arranged for the different departments and foremen, as shown in Fig. 1.

A similar calendar file is provided for the office of each department or foreman with rows of pockets for a machine,

HULL NO.____________ PLANNING SHEET FOR CONSTRUCTION—(ASSEMBLING)

FOREMAN____________________ *PROGRESS SCHEDULE*

QUANTITY	DESCRIPTION OF JOB	DR. NO.	BM. NO.	NO. MEN REQUIRED	TIME REQUIRED	TOTAL TIME	DATE / NO. OF PIECES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75

Fig. 5

group of machines, branch or section of the department, man, gang or squad.

Many of the departments will not need more than one row of thirty or forty pockets.

Application of the Planning System

For the purposes of the planning department the work entering into the production of a vessel is divided into two principal classes, manufacturing and assembling.

Manufactured jobs are those covering specific articles or items made in the pattern shop, foundry, machine shop, forge shop, boiler shop, joiner shop or sheet metal shop. These jobs represent such items as hawse pipe pattern, hawse pipe casting, fore foot casting, steering engine, ballast manifold, forged stanchions, boiler, clothes locker, berth with drawers, sheet metal vegetable locker, etc.

Assembling jobs are those done throughout the yard, assembling parks, building slips, fitting out wharf, pipe shop, copper shop, anglesmith's shop and plate and angle furnace shop. They represent specific portions of work to be done by a man, gang or squad and the work is such that the artisan will not be interrupted from the time he starts until the job is finished. In other words, the work can be completed by one man or gang without depending upon assistance from several different crafts.

These assembling jobs may be such as laying down, fairing up and scrieving in the forebody on the loft floor, to be complete in every respect including plate edges; laying out holes in tank top and bulkheads for bilge, ballast and fuel oil piping; installing boiler mountings; bending and fitting main steam pipes; setting up keel and bilge blocks; riveting bulkhead number 54, including clips, stiffeners, brackets and flanges of bounding bars to bulkhead; boring stern frame for stern tube, etc.

Assembling jobs are charted as shown in Fig. 5, the work of each foreman being listed on a separate sheet. Estimates of the time needed and the number of men required are indicated in the proper columns at the left. The period during which the work shall be done is next indicated by an X in the squares at the right under the dates the job should start and finish. The assigning of the jobs to a date or period is done so that the work in all departments will be undertaken in proper sequence and at such times as will meet the demand for efficiency and economy in production.

Manufactured items are charted as shown on Fig. 6, and assigned dates for completion similar to the assembling jobs. These dates must agree with the assembling charts which have already been made out. Duplicate cards as shown in Fig. 2, are then prepared for each manufactured job or item. One of these is filed in the planning office calendar file under the date the item should be finished and ready for assembling and the other is sent to the department that will do the work. When the item is finished, the shop card is returned to the planning department serving as a notice that the work is done.

The manufactured items are then subdivided into specific jobs for a machine, man, gang or squad, and these jobs written on cards as shown in Fig. 3, four cards being provided for each job. One of these cards is typed on the face of an envelope, which serves as the original, the duplicates being obtained by inserting them in the envelope with carbon paper between. On these cards the jobs are broken up into operations and the allowable time for performing each operation indicated at the right. The cards also show a description and sketch of the part to be made with instructions in detail, the date to start and finish, drawing number, bill of material number, machine number or department to which the job is assigned, rate, amount, location of material needed, and where the item is to be sent when finished.

One of these cards is filed in the calendar file in the planning office under the date the job is to start and on the row for the shop or department to which assigned. The other cards, including the one on the face of the envelope, are sent to the department assigned the work where they are filed in a calendar file under the date the job is to start and on the row for the machine, group of machines, department branch, man, gang or squad that will carry it out. The

HULL NO.__________ PLANNING SHEET FOR MANUFACTURED ITEMS

FOREMAN____________________ *PROGRESS SCHEDULE*

QUANTITY	ITEM	DR. NO.	BM. NO.	SHIP TO	DATE / JOB NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	8	69	70	71	72	73	74	75	76	77	78	79	80

Fig. 6

foreman then has his work laid out for him well in advance and assigns the jobs to the workmen in the sequence that they come in the file which conforms to the order laid out by the planners. No harm will result from doing these jobs ahead of schedule dates, but delays are likely somewhere in the plant if a job is not finished on schedule time. The foremen are held responsible for completing work on time and for advising the planner of any delays that seem likely to occur, the necessity for progress men being eliminated in this way. By the above means, the foreman in charge of the men has written instruction in the form of job cards of what to do, when to do it and how to do it. The foreman that cannot follow up these job cards or orders should be replaced.

After the assembling jobs are written on the charts as previously described, they are also written on job cards as shown in Fig. 4. The original is made on the face of an envelope, as described for the manufactured items, copies being provided for the foreman directly in charge of the work, for the planning department, and one copy for each workman. The original on the envelope is for the time-keeping department. These job cards show a description of the job with such instructions as may be necessary to have the foreman and workman understand exactly what is required. The card also shows the name of the foreman responsible for the work with his department symbol, the date to start and finish the job, the number of men required, compensation rate and time allowed to do the job, number of pieces, drawing number and bill of material number. Spaces are provided on the card for punching the starting and finishing time and date with a time clock, and for indicating the amount of time actually taken to do the job, amount of bonus, the workmen's names and numbers and for the signature of the foreman under a printed statement that the job has been completed according to instructions.

The job card for the planning department is filed in the calendar file on the row of the department responsible for the work and under the date the job should be started. The other copies, including the original, are dispatched, with material orders necessary, to the office of the department which will do the job and filed in a calendar file under the date the job should start. These calendar files do not need more than thirty or forty pockets, and for small departments the cards may be filed in an ordinary folder such as a letter file. In this manner the work is arranged for every department and the foremen know exactly what to do and when to do it in order to keep things moving according to schedule and prevent delays which are liable to upset the work of other departments. The foremen are held strictly responsible for completing work on time and for advising the planner immediately should delay from any cause seem likely.

Time-Keeping System

As the direct labor charges form a large percentage of the cost of work, no system will function satisfactorily unless means are provided for accurately keeping track of and following up these charges. The following, therefore, is an important part of the system.

A time card is provided for each man each day with his name and number printed thereon. It is put in a case at the entrance gate before the workman arrives. This card is a three part card made as shown in Fig. 7, so that it can be cut in three parts.

The first part is for the time-keeping department and shows the man's name and number, the symbol of the department in which he works and spaces in which to punch the time and date of entering and leaving the yard; also the job card number, actual number of hours worked during the shift, date, time of starting and finishing and the foreman's name under whose supervision he comes.

The second part is for the accounting department and shows the date, workman's number and department symbol, number of hours worked, rate, amount and the charge number or symbol.

The third part is for the planning department and shows the workman's name, number and department symbol, number of hours worked, rate, amount, number of job card to which the time is charged and the dates or periods the job was scheduled by the planning department to start and finish.

When the workman enters the gate at the beginning of a shift he removes his card from the case and punches the time with a time clock. He then turns the card in to his foreman or shop timekeeper, who fills out the blank spaces during the shift and returns it at the end of the shift. The workman then punches the card with the time clock as he passes through the exit gate and leaves it in a box for the timekeeping department which cuts the card into the three parts and sends each part to the department where it belongs. The parts for the timekeeping and accounting departments are cared for in a manner quite well known and not covered here. The part for the planning department is put into the job card envelopes in the calendar file, these envelopes having been returned from the foremen's offices when the job was assigned to the workmen as described below. The planning department, therefore, has a complete record of the time and cost of each workman on every job.

Dept. No................ Name..

....

Punch Time and Date

Entered ....Exit ....

Job Card Number.....................Total Hrs............................

....

Punch Time and Date

Starting ....Finishing ....

O. K.............................

Foreman......................................

Dept..............No..............Date..............Chg. No................

No. Hrs...................Rate...................Amount...................

Dept. ....No. ....Name ....

Job No...........................Sequent Dates..............................

No. Hrs...................Rate...................Amount...................

Fig. 7

Carrying Out the Work

The jobs on file in the offices of the foremen or departments are assigned to the workmen in the sequence in which they appear in the file, but not necessarily on the date as long as it is possible to do the job advantageously and causes no interference with other departments. However, care should be taken that they are started, and particularly finished, by the dates given as failure to do this might cause delay in some other department and have more or less bearing on the delivery of the vessel. The foreman in charge of the men assigns these jobs and is responsible for having them completed on time or for advising the planner of any possible delays in time to rearrange the schedule.

When a job is assigned the workmen's names and numbers are written on the cards and the starting time and date punched on them and also on the workmen's time cards and the foreman retains his copy as a memorandum of the work being done under his supervision. The original on the envelope is sent to the planning department where it is filed in the calendar file with the copy already in the file as described above and serves as a notice that the job is started.

The receipt of time cards should immediately follow and these are placed in the job card envelopes each day. These time cards are evidence that the work is progressing and will also quickly show up any excessive charges against a particular job.

Each day the job cards in the calendar file are moved one pocket or one day ahead. If there is a planners' copy of a job card in the file under the previous date that has not been inserted in an envelope, it is noted at once and in this way the progress in any and all departments automatically shows up.

Upon the completion of the job, the foreman inspects the work to see that it is done properly, then signs the workmen's job cards and his own. The workmen retain their job cards to present to the paymaster for payment and the foreman sends his copy to the planning department where it serves as a notice that the job has been completed. The job card envelope is then taken out of the file, the actual amount of time and money expended is totaled up from the time cards in the envelope. These totals are then written on the planner's copy of the job card and filed away for reference in planning and estimating the cost of new work. The totals are also written on the envelope sent in by the foreman and it is then dispatched to the time keeping department. After checking the figures and computing bonuses, the time keeping department reports to the paymaster the amount due the workman when he presents his job card.

Compensation

The character of work carried on in a shipyard is such that a uniform system of compensation, except that based on hourly or daily rates, is practically impossible. Hourly or daily rates are not conducive to economy and while piece-work prices can be established in many cases, there are others where such a basis is most difficult to apply. Hence, there are usually a number of methods applicable to work in different parts of the plant, the particular method in each case being determined by the operations involved.

Among the methods for compensation successfully applied with the system outlined are the direct bonus, time bonus, split time bonus, contract, piece work and piece work in berths.

Berthing is very well applied in the construction to bolting up, drilling and reaming, riveting, chipping and calking, packing, painting and cleaning. Berth means location or place and berthing is locating or assigning a specific place or part of a vessel to a man, gang or squad to complete in the sequence in which it is planned and in a manner that will not require any going back for small portions of the work carelessly left unfinished, as odd jobs are expensive after the workman has gone to some other part of the vessel or yard.

The standard form of job card is used for berthing and the workmen are held responsible for the completion of their berth.

The foremen directly over the men receive bonuses based on the amount of bonuses paid the men under their supervision and are penalized for passing any work that has to be done over in whole or in part. It is therefore in a foreman's interest to have his men attain the highest efficiency possible consistent with satisfactory work.

The planners are men of high standing in whom great confidence is placed, though perhaps not more than is usually placed in a department head of a large organization. These men should receive bonuses based on the earnings of the company because they exert a great influence on efficient and economical production.

The bonus for some work should be based on bonuses paid for other work upon which it is dependent. Such a job may be the lining up of boilers which is done by machinists while the work of putting the boilers in place is done by riggers who cannot clear away their gear until the boilers are permanently located.

The machinist has very little work to do, but he can cause a lot of delay if he is not on hand with the necessary tools when he is required by the riggers. When it is to the machinist's interest to have the riggers finish the job quickly, he is more willing to render as much assistance as possible and at least will be on hand to see that there is no delay on his part.

There is scarcely an operation in the building of a vessel to which some form of premium compensation cannot be applied. Where such is done, labor efficiency will take care of itself, provided a reasonable amount of care has been exercised in selecting men to build and maintain the organization.

The preparations of time estimates or rate setting for each job should be done with care and can, if desired, be assigned to a special group of men known as rate setters. The basis for figuring rates should be an analysis of information concerning operations, piece work rates or time studies which has been prepared from returns on previous work of similar nature.

A thorough knowledge of the work to be done is prerequisite as is also a reasonable amount of good judgment.

The records compiled in the planning office as previously outlined are the most accurate guides for making rates which become practically standard after the system has been used for a while. In fact the work of planning and rating gradually becomes a matter of reapplication from one contract to another by simply making such changes as are found to be advisable and which are necessary to meet the plans and specifications of the new contract.

Summing Up

The foregoing is a simple system that can be gradually introduced into any established organization without disrupting the personnel or interfering with production during its inauguration.

The department head may become the planner for his department and his assistant the executor of his plans; the sub-foremen become the assistants of the executor and the clerk of a department may become the planner's clerk in the planning office, caring for the job cards and time cards in the calendar file and such other routine as there is to do. The department timekeeper may remain in the same position looking after the time cards of the workmen and performing such other duties as may be required. The system is flexible so that where all the persons mentioned are not required the work can be arranged to provide for one man doing as much as the volume of business will permit. Where only a few men are employed in his department it would not be impossible for the planner to do all the work that the system

requires. It should be kept in mind, however, that the planner is the master of his craft.

In conformity with the above arrangement, the assistant superintendent would become the head of the planning department and the superintendent the production manager.

Conclusion

The chief advantage of the foregoing system is that it provides a method of positively controlling every activity involving direct labor expense and that it will reduce overhead in addition to insuring an orderly sequence of the work. With this method there is no such thing as "bluffing" along anywhere in the organization because, if a workman, foreman or department head cannot carry the responsibilities of his position, the fact begins to show very soon in the figures returned. Every workman on the payroll is contributing to production by doing work that has been previously planned, scheduled (assigned to a definite date), and rated and which is on record in the calendar file in the planning office.

The planners devote their time to planning their work ahead so that the material needed will be at hand when required and the work will go forward in the proper order and information of possible delays or excessive charges is obtained far enough in advance to allow corrective measures being taken to offset losses.

Reports are made out at regular intervals by the planner's clerks. These can be made in a number of ways to show the actual progress of the work in relation to the planning, the actual cost in relation to the estimated costs, the relative progress of the different departments and the efficiency in any detail that may be desired, extending, if necessary, to each job or man, gang, or squad.

With the information contained in the calendar file an ingenious clerk can compile statistics in reports or graphics that will show most anything that may be desired concerning the production in the plant.

There is actually a detailed cost account available for every job which has been prepared at no extra expense, which is accurate and which will locate leaks and show up inefficiency before there is a loss of any magnitude.

Knowledge of actual costs is most essential when preparing estimates, especially when the competitive bidding is keen and in making up a financial statement the expenditures on work under construction will mean a great deal when compared with the estimated labor costs.

By a physical survey of the plant, it is very difficult to detect the dropping behind of any department until it is really in bad shape and perhaps holding up work in other departments which is sure to cause a loss through workmen standing idle or working to a disadvantage while the department that is behind catches up with its work, if it can. The progress records show the slightest variation and give the department head and superintendent an opportunity to guard against loss from this cause.

There is no part of this system that is not an actual function in a plant without it, but by systematizing the supervision along sound business principles, duplication of effort and uncertainty of action are eliminated.

Activity Shown in Requests for Marine Exhibit Space

Thirty-Eight Companies Given Booth Numbers for Exposition to Be Held November 4-11—Twelve New Members Join Recently Incorporated Association

With America's maritime situation the prominent feature before the public at present, in connection with the ship subsidy bill awaiting definite action by Congress, it is interesting to note the steadily growing interest in the Marine Exposition scheduled for the week of November 4-11 at the Grand Central Palace, New York City. The latest announcement from the American Marine Association, under whose auspices the exhibition will be held, states that the incorporation of the association has now been completed, the corporate name being American Marine Association, Inc., and that 38 companies actively interested in the construction, repair and equipment of vessels have already signified their intention of taking part in the show and have been officially alloted space. It is also stated that 12 new members, many of them among the largest concerns in the marine industry, have recently been added to the membership of the association.

The early response on the part of exhibitors is considered as highly gratifying to the exhibits committee, the latter being composed of Gardner Cornett, of the Pneumercator Company (chairman); K. W. Heinrich, Bethlehem Shipbuilding Corporation; Frank J. Shipman, Texas Company; W. H. Raab, Todd Shipyards Corporation, and A. S. Hoffman of the Griscom-Russell Company. The official allotment of space and booth numbers made at a meeting of the exhibits committee held on June 1 are as follows:

American Manganese Bronze Company, 2; General Electric Company, 3, 4, 5, 6; C. H. Wheeler Manufacturing Company, 7; Pneumercator Company, 8; Victor Engineering Company, 12; C. A. Woolsey Paint & Color Company, 13; Peabody Engineering Company, 15; The Texas Company, 16; McCormick, McPherson & Lapham (San Francisco, Cal.) 17; Ashton Valve Company, 21; The Sperry Gyroscope Company, 22, 23, 24; W. & J. Tiebout, 29; Pantasote Company, 30; Lee & Simmons, Inc., 31; The Crandall Engineering Company, 38; The Babcock & Wilcox Company, 42; Simmons-Boardman Publishing Company, 51; Ellcon Company, 53; Northern Fire Apparatus Company, 55; Coen Company, 57; National Malleable Castings Company, 58; Scovill Manufacturing Company, 59; Griscom-Russell Company, 60; Diamond Power Specialty Corporation, 63; The Superheater Company, 66; Crane Company, 68; Bethlehem Shipbuilding Corporation, Ltd., 70, 72; The Sterling-Cooper Corporation, 71; Todd Shipyards Corporation, 84, 88; Westinghouse Electric & Manufacturing Company, 85, 87; Marine Decking and Supply Company, 96; Lunkenheimer Company, 99; Worthington Pump & Machinery Corporation, 100; Kingsbury Machine Works, 101; The H. E. Boucher Manufacturing Company, 108; B. F. Sturtevant Company, 111; Crane Packing Company, 305; The Stamford Foundry Company 327.

It is also announced that Valentine & Company, New York City, has also made a reservation of space and a number of other concerns have already signified their intention of exhibiting.

The Association is conducting a drive for new members, the results of which to date have been highly gratifying to all concerned.

The office of the association is in Room 1624, 15 Park Row, New York City. Telephone, Barclay 5458.

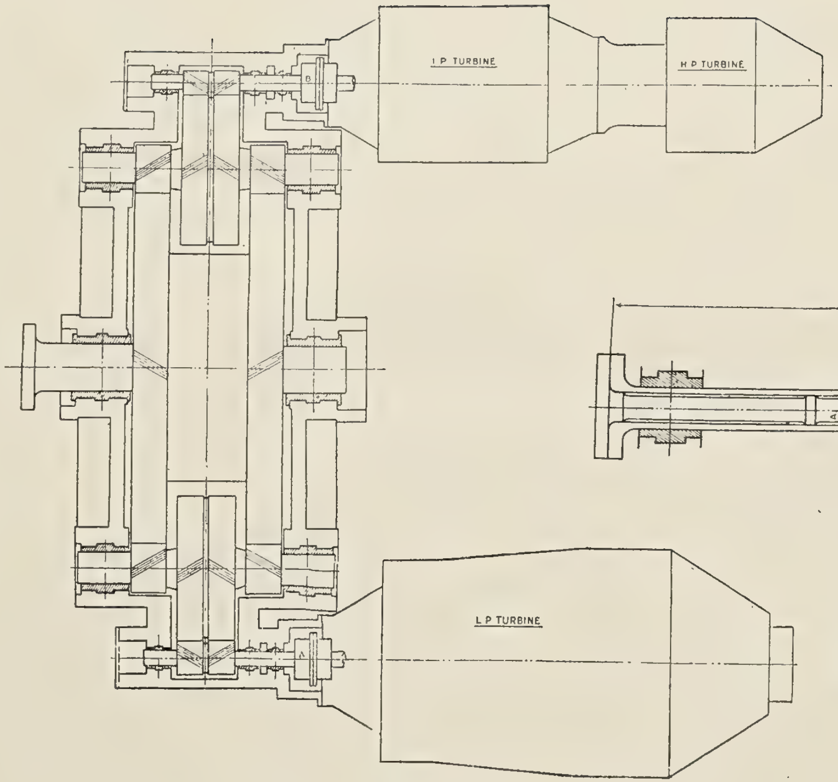


Fig. 1.

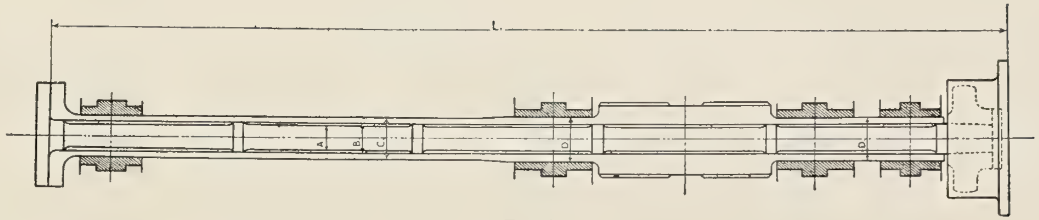


Fig. 2.

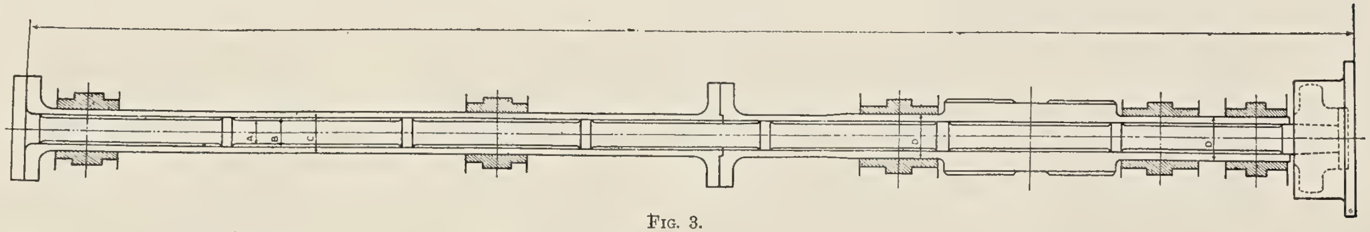


Fig. 3.

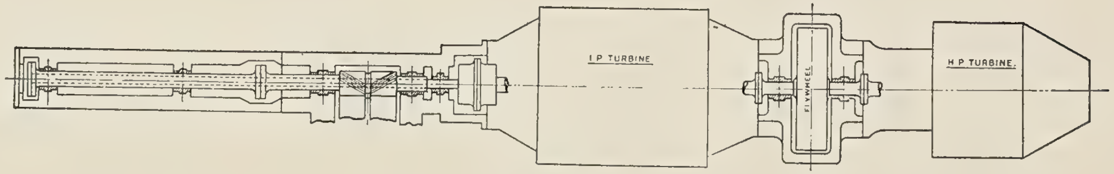


Fig. 4.

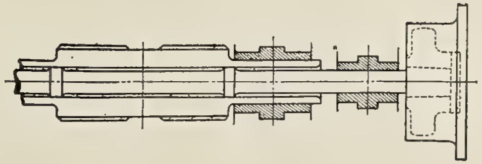


Fig. 6.

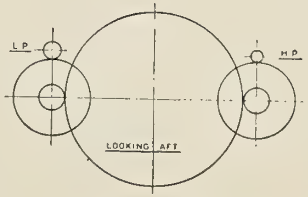


Fig. 1a.

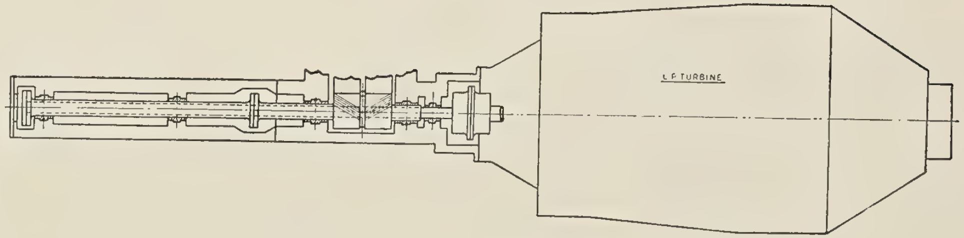


Fig. 5.

Figs. 1-6.—Arrangement of Turbines and Double Reduction Gears on S. S. Melmore Head, Showing Nodal Drive

Double Reduction Gears in the S. S. Melmore Head*

Successful Running of the Gears Secured by Tuning of Periodicities of the Rotating Masses of the System

By J. Wilkie

In the controversy which has centered round the problem of double reduction gears during the past few years, it has been exceedingly difficult to collect reliable information regarding the troubles which have been experienced with this type of drive. Excessive noise in the engine room, with hammering of the gears, would appear to have been all too common in gear-driven ships. When this is the case, heavy flaking of the gears in the neighborhood of the pitch line occurs, with grooving and deformation of the teeth and occasional fractures of the teeth, which clearly suggest fatigue of the material.

While this must have been the experience of many, there are those who assert that there is nothing wrong with double reduction gearing. If this is the case, one naturally wonders why it should be necessary to run many of our geared ships at reduced powers, and to design the gears for new installations at half of the original tooth pressures, thereby greatly increasing the weight and cost of gears.

With so much conflicting evidence, there is good ground for the appeals which have been made for giving all the facts available regarding the performance of double reduction gears at sea.

By the courtesy of the directors of the Ulster Steamship Company and the directors of Messrs. Workman, Clark & Company, of Belfast, the author is enabled to give a detailed account of the troubles experienced with double reduction gearing in the *Melmore Head,* together with a description of the methods recently adopted to overcome these troubles.

The *Melmore Head* is a single screw steamer of 2,500 shaft horsepower driven by double reduction geared turbines. This ship was built and engined by Messrs. Workman, Clark & Company, and delivered to her owners in September, 1918.

Fig. 1 shows in plan the arrangement of the turbines and gear, while Fig. 1a shows the relative positions of the pinions and wheels. The revolutions of the various elements are:

High pressure, and intermediate pressure turbines and pinions	3,600 per minute
Low pressure turbine and pinions	2,400 per minute
Second reduction pinions	560 per minute
Main shaft	70 per minute

The second reduction gears are designed for a working pressure of 1,000 pounds per inch width of tooth, and at 70 revolutions per minute the constant $P/\sqrt{d}$ is 274. The machinery is placed amidships, and the length of the main propelling shaft from the gear to the propeller is 144 feet.

In her regular service across the North Atlantic the *Melmore Head* makes the outward voyage in ballast and the homeward voyage loaded.

As several sets of gearing have been fitted to the original gear case at different times, these will be designated by numbers in order that the sequence of events may be clearly followed. Particulars of the various gear arrangements are given in Table I.

TABLE I

	Gear No. 1		Gear No. 2		Gear No. 3		Gear No. 4		Gear No. 5		Gear No. 6	
	P.C.D.* Inches	Circular Pitch Inches	P.C.D. Inches	Circular Pitch Inches	P.C.D. Inches	Circular Pitch Inches	P.C.D. Inches	Circular Pitch Inches	P.C.D. Inches	Circular Pitch Inches	P.C.D. Inches	Circular Pitch Inches
High pressure pinion	7.143	0.8976	7.06	0.6	Gear No. 2 retained		Gear No. 2 retained		7.06	0.6	7.062	0.6778
High pressure primary wheel	45.714	0.8976	45.798	0.6	Gear No. 2 retained		Gear No. 2 retained		Gear No. 2 retained		45.795	0.6778
Low pressure pinion	10.000	0.8976	9.923	0.6	Gear No. 2 retained		9.925	0.6778	9.925	0.6778	Gear No. 5 retained	
Low pressure primary wheel	42.857	0.8976	42.935	0.6	Gear No. 2 retained		42.936	0.6778	Gear No. 4 retained		Gear No. 4 Retained	
Second reduction pinions	13.333	2.094	13.507	0.8	13.495	1.1458	Gear No. 3 retained		Gear No. 3 retained		Gear No. 3 retained	
Main wheel	106.667	2.094	106.493	0.8	106.504	1.1458	Gear No. 3 retained		Gear No. 3 retained		Gear No. 3 retained	

*P.C.D. = Pitch Circle Diameter
NOTE.—Figures are inserted where the parts have been renewed.

Gear No. 1

In erecting this gear in the shop every precaution was taken to ensure accurate alinement, and the same care was taken to ensure this alinement being maintained when the gearing was transferred from the shop and put in position in the ship.

The running of this gear on the trial trip was very unsatisfactory. The noise in the engine room was deafening, while at the gear case it was evident that the gears were hammering each other in a most alarming fashion. This hammering of the gearing was not confined to any one particular speed, but could be distinctly traced at all speeds up to the maximum.

It was confidently expected that after a short time at sea the general conditions in the engine room would improve, that the teeth would become properly bedded to each other and that the hammering would cease. Such a state of affairs, however, was never realized and each succeeding report from the chief engineer merely indicated that matters were getting worse. This was confirmed by personal observations on the part of the author. It has been his practice, until quite recently, either to meet the ship on her arrival in Belfast Lough or to accompany her to her coaling ports on the Clyde or Bristol Channel, in order to trace the various developments in the problem.

*Paper read at sixty-third session of the Institution of Naval Architects, London, April, 1922.

A careful examination of the gearing at the end of the first voyage showed a considerable amount of flaking of the teeth and grooving at the pitch line. By the end of the second voyage this had increased considerably, and in addition, a sharp protruding edge was being formed on the teeth of the second reduction gears. This was removed before the third voyage was started. During the second voyage, also, considerable trouble had been experienced through choking of the oil filters by steel particles from the gearing and, in addition, a slight fore-and-aft movement of the second reduction pinions was detected.

The outward portion of the third voyage was safely completed, although the choking of the oil filters and the movement of the second reduction pinions were increasing. When 400 miles of the homeward voyage had been covered, however, the movement of the pinions had become so violent and the consequent pounding of the gears and vibration of the gear case so severe, that speed had to be reduced, and Norfolk, Va., was made with very great difficulty. In this port, temporary thrust pads had to be fitted to the ends of the second reduction pinions to hold them in position. By this means it was possible to run the machinery at a speed sufficient to maintain steerage way on the ship while she was being towed home by another of the company's vessels.

Between September, 1918, and April, 1919, when this gear collapsed, approximately 25,000 miles had been covered at full power. Particulars of the speeds and revolutions are given in Table II.

TABLE II.—Extracts from Log of S.S. *Melmore Head*

Voyage Number		Speed in Knots	R.P.M.	Gear
1.	Outwards	10.8	69.2	No. 1
	Homewards	10.8	70.0	No. 1
2.	Outwards	10.87	70.4	No. 1
	Homewards	11.1	69.0	No. 1
3.	Outwards	11.5	71.3	No. 1
4.	Outwards	12.2	71.0	No. 2
	Homewards	11.0	67.1	No. 2
5.	Outwards	11.6	72.0	No. 2
	Homewards	9.9	67.1	No. 2
6.	Outwards	11.7	71.6	No. 2
7.	Outwards	7.5	49.4	No. 3
	Homewards	7.8	50.5	No. 3
8.	Outwards	7.5	47.1	No. 3
	Homewards	7.7	48.3	No. 3
9.	Outwards	7.8	48.3	No. 3
	Homewards	6.3	47.4	No. 3
10.	Outwards	7.4	49.6	No. 4
	Homewards	8.0	52.6	No. 4
11.	Outwards	10.2	65.3	No. 5
	Homewards	8.0	52.7	No. 5
12.	Outwards	8.0	54.9	No. 6
	Homewards	9.4	59.6	No. 6
13.	Outwards	10.1	62.3	No. 6
	Homewards	9.9	63.2	No. 6
14.	Outwards	11.3	68.3	No. 6
	Homewards	9.9	64.0	No. 6
15.	Outwards	11.5	68.0	No. 6
	Homewards	9.5	62.5	No. 6

Two reasons were put forward for the failure of this gear; these were inaccuracies in cutting and faulty alinement. As regards alinement, great care had been taken with this in the course of construction, and when the gear wheels were removed it was again checked by mandrils in the gear case bearings and found to be correct. This being the case, the whole cause of the trouble was attributed to inaccurate cutting of the gears. It was decided, therefore, that new gears of finer pitch (particularly in the case of the second reduction gears) should be put in hand, and that these should be cut by a different firm of gear cutters.

Gear No. 2

The gear wheel and pinions in this case were mounted in the gear case on board the ship. The alinement of all the parts was carefully examined, and all concerned (including the gear cutters) were satisfied as to the accuracy of the work. Had any doubt existed, this was removed by an examination of the tooth markings after the trials had been run.

The performance of this set of gearing on trial showed very little improvement on the performance of the first set. The noise in the engine room was still excessive, and the hammering of the gears was much in evidence. Nevertheless, the ship went on her fourth voyage at her originally designed speed.

While this gear lasted the rattle and roar in the engine room remained undiminished. The gears were examined at the end of each voyage and, although the wear on the teeth did not appear to develop as rapidly as in the first gears, signs of the old troubles with flaking and grooving were not wanting.

At the end of the fourth voyage the pressure of the oil supply to the gears was increased by raising the level of the gravity supply pipes to the top of the engine room casing. No appreciable change in the noise resulted from this alteration, however, and the fifth voyage was completed under the similar uncomfortable conditions of previous voyages.

The sixth voyage of the ship, and the third with this set of gearing, saw the collapse of Gear No. 2. On the passage up the St. Lawrence River, the second reduction gears stripped half-way across the face of each pinion and wheel shroud.

Between August and November, 1919, this gear had completed approximately 14,000 miles at full speed. Temporary second reduction gears were dispatched to Canada, and after these were fitted up the ship returned to Belfast at about half power.

An examination of the fractured teeth of this second set of gears showed that all the teeth had been broken off sharp at the roots without any sign of elastic deformation. From this it was concluded that the material had given way under fatigue stress and this was subsequently confirmed by tests carried out at the steel works. It appeared, therefore, from an examination of all the facts available that stresses of a nature or magnitude not anticipated in the original designs were being transmitted through the gears and that lower tooth pressures would have to be employed, if the gearing was to be made to work satisfactorily.

Accordingly it was decided to re-design the gear case and to limit the maximum tooth pressure to 500 pounds per inch width. This gear was actually completed, but, as subsequent developments proved, it was never necessary to have it installed in the ship.

Gear No. 3

As the demand for tonnage at this time was very great, a third set of second reduction gearing was installed to work in conjunction with the primary gears retained from Gear No. 2. With this arrangement the ship was to be kept in commission at reduced power until the new gear case was ready.

Three voyages (Nos. 7, 8, and 9, Table II.) were completed with this arrangement before any modifications were made. The average speed over these three voyages was 7.5 knots at 48.5 revolutions, giving a value of 132 for the constant $P/\sqrt{d}$.

The running conditions with this gear, even at reduced power, were not too satisfactory. While the engine room conditions were certainly tolerable, there was clear evidence of the former hammering action of the gearing taking place. The intensity of this action was, of course, greatly diminished owing to the reduced speeds of rotation of the wheels, at the same time a reduction of the constant from 274 to 132 had not produced that smoothness of running and absence of noise so essential for the preservation of the gear for any considerable time.

In the author's opinion the method of attacking the gearing problem by simply reducing tooth pressures was not satisfactory. It seemed to be more or less a shot in the dark supported by no sound argument, and was likely to prove a tedious and costly method of experiment.

From a careful study of the observations made from time to time on the *Melmore Head,* the writer came to the conclusion that the gear transmission system as a whole was dynamically unsound and that, if satisfactory running of the gears was to be obtained, some consideration would have to be given to the inertia effects of the various rotating masses and particularly to the effect of torsional vibrations of the propelling shaft, arising from propeller action in a variable wake.

Shortly after the third gearing arrangement was installed, Professor Smith was called in to investigate the problem on behalf of the builders and the writer became associated with him in carrying out the subsequent changes which were made from time to time.

The mathematics of the problem have already been put before you in Dr. Smith's paper on "Nodal Arrangements of Geared Drives." The writer will, therefore, confine his remarks to a description of the various changes made on the *Melmore Head.*

It had been observed at various times that the hammering effects in the gear appeared to be most severe at the low pressure side. The reason for this was believed to be that, because of its mass and the rigidity of its connection to the gears, the low pressure turbine was unable to keep step with the fluctuations in speed of the main wheel which resulted from torsional oscillations of the main shaft. Parting of the teeth would, therefore, occur with hammering when contact was resumed. It was decided, therefore, as a first experiment to adjust the shaft connecting the low pressure turbine to its primary pinion in such a way as to make the periodicity of the free torsional oscillations of the low pressure turbine about the main gear wheel equal to the periodicity of the free torsional oscillations of the propeller about the main gear wheel.

Gear No. 4

To carry out the idea of tuning the low pressure turbine and its driving shaft to the same periodicity as the propeller and propeller shaft, the pinion shaft A in Fig. 1 was removed and replaced by a hollow bored pinion shaft with an internal flexible driving shaft as illustrated in Fig. 2. The principal dimensions of this arrangement were A = 2 9/16 inches, B = 2 11/16 inches, C = 4 1/16 inches, D = 4½ inches, L = 7 feet 10 inches. The stress on the internal shaft was 9,900 pounds per square inch. The collars on the internal shaft were made a sliding fit in the bore of the pinion shaft and were introduced to prevent any possible whipping of the internal shaft.

As the primary wheel on this side of the gearing was badly grooved, it was decided to renew this wheel in addition to fitting the new pinion. *Otherwise it is to be particularly noted that no other change was made on the gearing and that the second reduction gears remained exactly as when originally fitted in arrangement No. 3 at the end of voyage No. 6.*

This arrangement was thoroughly tested on trials run at full power in Belfast Lough. The effect produced in the running of the gear by the introduction of this flexible drive was most encouraging. The hammering of the gears had entirely disappeared at the low pressure side, and instead, a pure rolling of the teeth was produced. The gear case which had previously vibrated considerably was now perfectly steady and generally the conditions in the engine room were comfortable. As was anticipated, of course, hammering was still evident at the high pressure side of the gears, due to the fact that no adjustments had been made on that side.

Although the trials of this arrangement had proved so satisfactory, it was decided to make the next voyage at a speed not exceeding 50 revolutions per minute. The reason for this decision was that the arrangement was purely experimental and of a temporary nature, and the stresses adopted for the flexible driving shaft were unusually high. This voyage—No. 10 in Table II—was successfully completed and at its conclusion a careful examination of the gears showed no grooving or pitting of the teeth. It may be argued, of course, that one voyage of approximately 7,000 miles is too short a period in which to draw any conclusions as to the condition of the teeth. With the first and second gears, however, there was no doubt as to what was happening to the gear teeth long before that distance had been completed.

Gear No. 5

As a result of the experience gained in the first experiment, it was now decided to tune both turbines and their driving shafts to the same periodicity as the propeller shaft. This time the stresses in the driving shaft were reduced from 9,900 to 7,500 pounds in order to provide a sufficient margin of safety for continuous working at full power. Stresses lower than 7,500 pounds were considered impossible in this ship, as the driving shafts would have become too long to be satisfactorily supported.

Pinion shafts A and B in Fig. 1 were replaced by hollow bored pinion shafts with extension sleeves and internal shafts as shown in Fig. 3. The principal dimensions of these shafts were:

	High Pressure Side	Low Pressure Side
A	2½ inches	2 13/16 inches
B	3 inches	3⅜ inches
C	4¼ inches	4½ inches
D	4½ inches	4½ inches
L	10 feet 10 3/16 inches	10 feet 10 3/16 inches

As the length of the high pressure driving shaft could not be made sufficiently long to completely tune this side of the system, it became necessary to increase the inertia effect of the high pressure and intermediate pressure turbines in order to tune them to the same periodicity as the propeller, and to obtain an approximate balance between the two sides of the driving system. This increase of inertia was accomplished by introducing a flywheel between the high pressure and intermediate pressure turbines. The position of the flywheel between the turbines was chosen with the idea of binding the three elements in such a way as to form approximately one rigid mass and thus avoid the possibility of independent vibrations being set up between those three units.

This flywheel with its shafts was a solid forging of 34-38 tons steel, the diameter of the wheel being 3 feet ½ inch, the breadth 9 3/16 inches, and the weight 2,720 pounds. The flywheel is shown in Fig. 4.

This arrangement of flexible shafts and flywheel was fitted up at the conclusion of voyage No. 10. It is again to be particularly noted that *no adjustments were made on the second reduction gears, these remaining exactly as when originally fitted at the end of voyage No. 6.*

Trials at full power were run with this arrangement, and the results were considered to be very satisfactory. The absence of hammering in the low pressure primary gear and at both sides of the secondary gears was particularly noticeable. One defect remained, however, which subsequently proved to be more important than was anticipated. Doubtless many of you were present when these trials were run in Belfast Lough, and you may have noticed a slight vibration at the high pressure primary gear.

When the new pinion and flexible shaft were fitted to the high pressure side, no change was made in the primary wheel. This wheel remained from Gear No. 2 and, as it was only slightly grooved, it was considered that it would run quietly with the new pinion and the flexible drive. On

the trials, however, this condition was not quite realized and a slight vibration developed at the high pressure primary gear.

With this one apparent defect remaining the ship set out on her eleventh voyage, the outward portion of which was completed at an average of 65.3 revolutions. The vibration at the high pressure primary gear had increased somewhat by the end of this outward voyage and, as it continued to increase during the homeward passage, speed was reduced and the voyage completed at an average of 52.7 revolutions.

Gear No. 6

An examination of the high pressure pinion at the end of this voyage showed that it had become grooved in exactly the same fashion as the primary wheel. It was evident, therefore, that to set a new and well-cut pinion to work in a worn wheel and expect quiet running conditions was a mistake, consequently both the high pressure pinion and primary wheel had to be renewed.

The flexible shafts were also withdrawn for examination at this time and it was found that the collar at the flexible coupling end of each driving shaft showed considerable wear. This necessitated a modification of the design and a bearing coupled to the forced lubrication system was fitted as shown in Fig. 6. This is the last modification that it has been found necessary to make on the gears of the *Melmore Head.* Fig. 4 shows the arrangement of the "nodal drive" as applied to the high pressure driving element and Fig. 5 shows the arrangement as applied to the low pressure driving element.

With this arrangement the ship has been in continuous service and is giving complete satisfaction. Up to the time of writing, voyages 12, 13, 14 and 15 have been completed. The average revolutions for the twelfth voyage and the remaining homeward voyages are low, due entirely to the poor quality of coal.

The condition of the gearing is perfect. So far, no "pitting" has appeared on the primary gears and only very light "pitting" along the pitch line of the secondary gears, which occurred prior to the carrying out of these experiments, and has not developed since. There is absolutely no trace of a beat in the gear case while running up to full power.

The second reduction gears have now completed approximately 50,000 miles, 16,000 before fitting the "nodal drive" and 34,000 miles since the experimental work commenced.

The writer would like to draw attention to the fact that all these changes in the *Melmore Head* have been carried out in the gear case originally fitted in the ship in 1918. No alterations have been made beyond those already described in the paper, and consequently the continued successful running of this gear is entirely due to the tuning of the periodicities of the various rotating masses of the system.

In conclusion, the writer wishes to express his indebtedness to the directors of the Ulster Steamship Company, and Messrs. Workman, Clark & Company for placing at his disposal valuable information regarding the *Melmore Head.*

Cement and Concrete for Shipbuilding Purposes—III

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials' point of view.

There are a number of coatings designed to protect concrete surfaces in oil tanks or elsewhere, on the ground that the oil disintegrates the concrete. An inspection made by the Bureau of Standards in 1917 of reinforced concrete oil tanks then in service indicated that such was not the case as far as mineral oils are concerned, and that these oils have no deleterious effect on concrete that is properly cured before contact with the oil. A series of tests subsequently made confirmed this with the possible exception of very light oils, but showed that certain organic oils do have a destructive effect on concrete. For marine service oilproof coatings should be of such a nature as to be unaffected by water.

Materials for Oilproof Coatings

Tests made of perilla oil indicate that it is unaffected by exposure to gasoline, kerosene, crude oil and vegetable oils.

Some oil proof coatings have shellac as a base, with alcohol as a thinner, with a pigment and possibly other materials. Such compounds, while oilproof, are not waterproof, and are therefore undesirable in marine service. These coatings are also apt to be brittle.

Concentrated sulphite pulp mill liquor is also marketed for this purpose. It has good adhesive power on concrete surfaces and gives an oil proof coating, but is softened by water.

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

The coating adopted by the Shipping Board for the oil tanks of their concrete tankers was a high grade of spar varnish, resistant to air, light and water. Very detailed specifications and test requirements were prepared and successfully met by several of the paint and varnish manufacturers. The method of application was:

First Coat—To be applied on concrete which has been treated with magnesium fluosilicate solution and which has been dried at least 24 hours with good ventilation. Thin the varnish by adding 20 percent of volatile mineral spirits and apply with brush or air gun at 60 to 70 pounds pressure, a thin coat covering all portions of the surface, allowing no varnish to flow down vertical surfaces. Allow to dry hard; at least 24 hours being necessary, 48 hours is better. In confined spaces, during the application and during at least the first 24 hours of the drying period, artificial ventilation shall be provided.

First Coat on Other Paints and All Second and Third Coats—Apply the varnish without thinning, with brush, or with air gun at about 40 pounds air pressure. The above remarks as to covering, drying period and ventilation shall govern in all cases.

After about two years of experimentation the coating was modified to require a layer of cheese cloth between the second coat of varnish and a third coat of varnish or of so-called gray enamel, which consisted of 55 to 60 percent of the varnish and the balance of white lead pigment. The application of the cheese cloth on large surfaces, however, was found to be impracticable and its use was abandoned. The varnish itself, as has been mentioned, is difficult to apply in the hold of a vessel, where, even with the most favorable weather conditions, it is hard to obtain sufficient

light and air for proper drying. It is also injuriously affected by alkali salts in the concrete.

The Tentative Standard Specifications require that concrete structures for containing light mineral oils, animal oils, certain vegetable oils, and other commercial liquids shall be given a special coating which shall be applied immediately after construction. Floors or other surfaces exposed to heavy concentrations of such oils or liquids shall be similarly protected. The treatment to be applied shall be approved by the engineer.

The writer is of the opinion that it is neither necessary nor advisable to coat concrete oil tankers as a protection from mineral oil or to coat oil tanks for carrying the oils usually met with except as a protection from water. Apart from the use of penetrating oils or other special applications, coating the surface with thin cement grout should suffice; and such practice has the approval of the Bureau of Standards for oils of about 35 degrees Beaume or greater density. The film of oil deposited on the surface affords some protection against water when the tanks are being used for ballast. Examination of leakage in way of rivets or seams of steel tanks carrying heavy mineral oil shows it to be of the nature of dark colored kerosene; so it does not seem unreasonable to extend the service of the grout coated oil tanks to carrying the lighter oils when necessary.

Materials for Hardening the Surface of Cement and Concrete

As has been stated in the article on deck coverings, cement and concrete surfaces under wear produce a fine powder, and the surface without special treatment is not as wear resistant as is desirable in some locations. This difficulty, which assumes some importance on concrete ships, can be overcome by surface hardening compounds.

Magnesium fluosilicate, either as such or under some trade name, has been used to a considerable extent for this pur-

A	B	C
	OUTER HULL SURFACES	
	Keel to Light Draft Line	
Magn. Fluosilicate ....1 application Spar Varnish ....2 coats Copper Bottom Paint........1 coat or other approved Antifouling.	Bituminous Primer C.S 37.........1 coat Bituminous Paint C.S. 38..........2 coats Approved Antifouling ....1 coat	Perilla Oil to full saturation C.S. 37 or equal.....................1 coat C.S. 38 or equal ....2 coats Approved Antifouling.
	Above Light Draft Line	
Magn. Fluosilicate ....1 application Spar Varnish ....2 coats Jet Black Varnish............1 coat	Bituminous Primer C.S. 37.........1 coat Bituminous Paint C.S. 38..........2 coats	Perilla Oil to full saturation C.S. 37 or equal.....................1 coat C.S. 38 or equal....................2 coats
	Exterior Walls of Houses, etc.	
Magn. Fluosilicate ....1 application Gray Enamel ....2 coats (or Spar Varnish 3 coats)	Magn. Fluosilicate ....1 application Gray Enamel ....2 coats	Perilla Oil to full saturation Gray Enamel ....2 coats
	Exposed Decks	
Bituminous Primer C.S. 9..........1 coat Asphalt Deck Flooring	Bituminous Primer C.S. 37........1 coat Asphalt Deck Flooring	C.S. 37 or equal ....1 coat Approved Bitumen Deck Covering
	INTERIOR HULL SURFACES	
	Water Ballast and Fresh Water Tanks	
Magn. Fluosilicate ....1 application Bituminous Primer C.S. 9....1 coat Bituminous Paint C.S. 10.....2 coats	Bituminous Primer C.S. 37.........1 coat Bituminous Paint C.S. 38...........2 coats	Perilla Oil to full saturation C.S. 37 or equal.....................1 coat C.S. 38 or equal....................2 coats
	Oil Tanks—Floors, Sides and Bulkheads	
Magn. Fluosilicate ....1 application Spar Varnish ....3 coats	Magn. Fluosilicate ....2 applications Spar Varnish ....2 coats One ply of cheese cloth applied while the second coat of varnish is still tacky Gray Enamel ....1 coat	Perilla Oil to full saturation Thin Portland cement grout........1 coat
	Dry Cargo Holds—Bottom and Bilges	
Magn. Fluosilicate ....1 application Spar Varnish ....3 coats	Bituminous Primer C.S. 37........1 coat Bituminous Paint C. S. 38.........2 coats	Perilla Oil to full saturation C.S. 37 or equal.....................1 coat C.S. 38 or equal....................2 coats
	Dry Cargo Holds—Side Walls, Bulkheads, etc.	
Magn. Fluosilicate ....1 application Spar Varnish ....2 coats	Bituminous Primer C.S. 37.........1 coat Bituminous Paint C.S. 38..........2 coats	C.S. 37 or equal....................1 coat C.S. 38 or equal....................2 coats
	Engine and Boiler Rooms—Bottom and Bilges	
Magn. Fluosilicate ....1 application Spar Varnish ....3 coats	Magn. Fluosilicate ....2 applications Spar Varnish ....2 coats Gray Enamel ....1 coat	Perilla Oil to full saturation Spar Varnish ....2 coats Gray Enamel ....1 coat
	Engine and Boiler Rooms—Sides, Bulkheads, etc.	
Magn. Fluosilicate ....1 application Spar Varnish ....2 coats	Magn. Fluosilicate ....2 applications Spar Varnish ....1 coat Gray or White Enamel......2 coats	Perilla Oil to full saturation Spar Varnish ....1 coat Gray or White Enamel.............2 coats
	Coal Bunkers	
Magn. Fluosilicate ....2 applications	Magn. Fluosilicate ....2 applications	Magn. Fluosilicate ....2 applications Perilla Oil to full saturation on bottom and bilges

pose. The Shipping Board used a 7½ percent solution, or 7½ pounds of the anhydrous salt to 100 pounds of water, which was made by diluting their standard specifications for this material, or other more concentrated solution, with fresh water. Their specification reads—

The material shall be clear, colorless solution of magnesium fluosilicate ($MgSiFl_6$) in water. The solution shall contain not less than 15 percent by weight of the salt $MgSiFl_6$ and shall not contain more than 1 percent of any other substance in solution, nor more than 0.2 percent of total chlorine.

The method of application, which was mainly for the purpose of neutralizing the free lime in the concrete, was:—

Apply with a wide brush or with air gun at low pressure, saturating the concrete surfaces, which shall be air dry before the application. Allow the concrete to dry before applying paint or varnish coats. Second application is made only where specified for hardening purposes. Apply 24 hours after the first application.

Some surface hardening compounds consist of a mixture of iron powder and ammonium chloride. It is sprinkled upon a fresh concrete surface and troweled in, or it is mixed with water, kept stirred and scrubbed upon concrete surfaces already set. The iron is supposed to rust and fill the pores of the concrete thus being a waterproofer as well as a hardener, and the ammonium chloride is to quicken the rusting action. Tests made by the Shipping Board showed that the treatment does make the surface harder; but the coating cracks with the concrete, so it is not valuable as a waterproofer.

Materials for Avoiding Trouble from Alkali Salts

Free lime in concrete comes to the surface and acts upon and saponifies the oil in protective coatings, thus destroying coatings of that nature. Avoidance of this trouble was the principal reason for the Shipping Board's use of magnesium fluosilicate solution. The results achieved, however, were of doubtful value. Zinc chloride is another surface application for this purpose.

Integral waterproofers of a siliceous character which are of benefit in this connection have been referred to.

Materials for Frost Proofing Cement and Concrete

The use of such materials in shipbuilding work is usually neither desirable nor necessary but it is well to know that they are available and that they have been the subject of favorable laboratory test as well as the test of actual use in construction on land. Salt has been used to a considerable extent and soda to some extent.

Their requirements are that they shall prevent the freezing and ensure the proper setting of the cement or concrete at the temperatures at which the work has to be performed; that they will not, in the amounts which have to be used, injuriously affect reinforcing steel or the tensile or compressive strength of the cement or concrete; and that they will not introduce any other deleterious factors.

The Tentative Standard Specifications state that salt, chemicals or other foreign materials shall not be used to prevent freezing.

Protective Coating Summary

In a consideration of protective coatings the steps taken in any progressive developments are of value as well as the final outcome. The following tabulation shows in a concise manner some of the Shipping Board's steps in developing coatings for the concrete oil tankers. Column A shows specifications as amended and adopted after about a year of research and test; and column B shows the requirements at the time of the breaking up of the Concrete Ship Section, when the work was turned over to the writer about a year later, with the construction well along. Column C embodies the writer's recommendations for such service.

It is well to note that antifouling oil paints or other oil paints cannot be used to make a satisfactory coating over bituminous paints. The oil and thinners in the former soften and blend with the latter and a very streaked and spotted coat results. When such a combination is exposed above water the outer coat checks and "alligators," due probably to being less elastic than the bitumen coating beneath it.

Asphalt Cement

This is a bituminous composition of the nature of bituminous enamel that is of value for filling in spaces which are subject to vibration, filling in between castings and steel plates which do not lie metal to metal, coating the bottoms of chain lockers, and other service where Portland cement would be apt to crack out or suffer damage. A bituminous priming coat should be first applied.

The Navy formula for the asphalt cement is:—

Ingredients	*Quantities required for* 100 *pounds*
Trinidad asphalt	15 pounds
Paving asphalt	51 1/5 pounds
Vulcanite special or Anchor Rock Brand asphalt	15 pounds
Rosin	1¼ pounds
Slaked lime	2½ pounds
Portland cement	17½ pounds

The asphalts and rosin are melted together, and when thoroughly mixed the Portland cement is added and the mixture well stirred. The fire is then drawn and the mixture is ready for use or storage.

Roman Cement

Roman cement is a natural hydraulic cement made by calcining and grinding a kind of cement rock which usually contains considerable iron oxide, thus giving the cement a red color, also manganese and more alumina than Portland cement. It is quick setting, hard and durable.

This material is of value on boiler room tank tops of oil burning vessels in place of the customary bituminous solution and enamel and is sometimes specified for such service. Spilled oil has a tendency to dissolve the bituminous coating and the fire hazard is also greater where such a coating is used.

Linoleum Cement

This material is of value to cement down linoleum or cork composition tiling and it is put on about ⅛ inch thick.

The Shipping Board Specifications for it are:—

This material shall be made as follows, using these exact relative proportions of ingredients:

Two ounces of real rubber shall be cut in one gallon of gasoline. This solution shall be added to a mixture of:

Thirty-two pounds of Grade A gum shellac cut in seven and one-half gallons of Clear Neutral Denatured Alcohol (No. 1 Internal Revenue Department Standard, 100 gallons grain alcohol and 5 gallons approved wood alcohol) to which solution has been added one hundred and twenty pounds of high grade Whiting.

The whole shall then be ground to an intimate mixture.

The whiting used shall contain no hydrated lime.

The Navy Department specifications for this material are somewhat similar to the above.

Smoothing Cement

Some compositions are required for evening off decks prior to laying linoleum and similar service. The Navy Department formula for such a cement is as follows:

Ingredients	*Quantities required for* 100 *pounds*
Venetian red, dry	10 pounds
Whiting	32 pounds
White lead, dry	16 pounds
Zinc oxide, American, dry	16 pounds
Litharge	16 pounds
Raw linseed oil	1½ gallons
Turpentine	¾ gallon
Japan drier	⅜ gallon

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

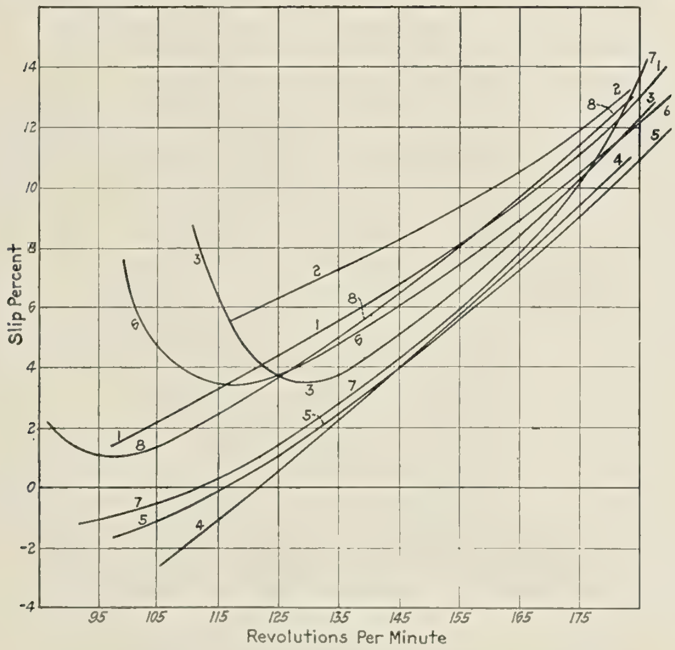
Unexplained Phenomena Developed in Tugboat Trials

Q. (1159).—The following data were obtained from the trial trips of eight boats (similar in all respects and constructed by a small shipyard) of a tug design about 100 feet long over all, 22 feet beam, 8 feet 3 inches mean draft, 260 tons displacement. Propeller 7 feet diameter, by 7 feet pitch, 4 blades. The trial trips were held in a depth of water of 28 to 32 feet, and over measured mile courses usually with a beam wind, over which six or more round trips were made to obtain the data.

In plotting the results obtained, especially the revolution-slip curve, a peculiar feature was noted on some of them, three became negative at slow speeds and three indicated a tendency to reverse, showing a minimum value for the apparent slip increasing either side of this for either an increased or decreased speed. This seemed peculiar, and it was thought that perhaps an error had crept in due to the wheelsman not having steered a straight course over the mile, but had see-sawed over the line.

What reasons would you assign for the characteristics of these curves as here shown, and why negative slip in some cases?

A. (1159).—On the basis of the information furnished, the writer has no explanation to offer relative either to the characteristics of the curves or the development of negative slip at the lower speeds in certain cases. It is possible that



Revolution-Slip Curves

with the aid of model tank effective horsepower curves and a fuller knowledge as to the conditions surrounding the trials of each vessel satisfactory reasons for the phenomena noted might be found.

It is suggested that any one or a combination of all the following might have been instrumental in producing the results obtained.

(a) Variations in propeller characteristics due to lack of uniformity in finish of blade faces.

(b) Inaccuracy in corrections for tide and wind on runs of opposite direction.

(c) Differences in displacement and trim at time of trials.

(d) Foulness of bottom and of propeller. These might easily have been important factors as the effect of fouling either on the vessel's bottom or on the propeller faces might render the relation between the vessel's speed and the revolutions of the propeller very uncertain.

Calculation of Lift of Valve

Q. (1158).—How would you figure the required lift of a valve to equal its diameter when the seat is mitered at a 45 degree angle?

A. (1158).—It is believed that the intent of the question is to ascertain the method of so figuring the valve lift that the flow of water past the edge of the valve disk will equal that through the valve seat. The following is based upon this understanding:

If there were no obstructions to the passage of the water through the opening in the valve seat, such as ribs and

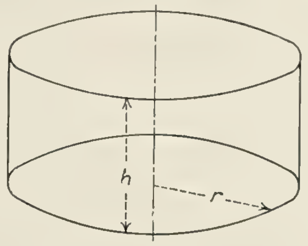


Fig. 1

bosses, and if no allowance were made for the effect of friction, change in direction of flow, etc., the problem would be simply that of finding the altitude of a cylinder such that its area of side is equal to the area of its base. In Fig. 1 let h = altitude of cylinder (valve lift) and r = radius of cylinder base (opening through valve seat). Then to meet the requirements of equal area

$$h \times 2\pi r \text{ must equal } \pi r^2$$

$$\text{and } h = \frac{\pi r^2}{2\pi r} = \frac{r}{2} = \frac{\text{diameter}}{4}$$

This merely expresses the generally accepted rule "valve lift equals ¼ diameter of valve opening."

In practice the valve is generally seated on a conical surface having an angle of 45 degrees, as you suggest. This surface is made as small as possible without unduly increasing the unit pressure exerted by the valve. On this account the above rule may be applied with substantial accuracy in practice, due allowance being made for obstructions in valve seat opening.

Uses of Specific Gravity

Q. (1162).—Of what uses to him are the specific gravity of the elements the marine engineer has to deal with? Give a simple rule, if any, for finding the weight, volume or specific gravity when only one or two of the three mentioned are known.

A. (1162).—Specific gravity of solids, liquids or gases, when known and used in conjunction with the weight of an

equal volume of water (for solids and liquids) and air (for gases) and the same temperature, determines the required unit weight of the substance in question. In other words, the two substances entering into the question must be at the same temperature and volume.

Example 1.—Required the weight of one gallon of fuel oil, the specific gravity of which is 0.9150. The weight of a gallon of water at 62 degrees F. (standard temperature) = 8.3356 pounds. Required weight = 0.9150 x 8.3356 = 7.627.

Example 2.—Required the specific gravity of fuel oil having a weight per gallon of 7.627 pounds at a temperature of 62 degrees F. As before with 8.3356 pounds as the weight of a gallon of water, we would have:

Specific gravity = 7.627 ÷ 8.3356 = 0.9150.

Example 3.—Required the volume of 10 pounds of fuel oil having a specific gravity of 0.9150 and a temperature of 62 degrees F.

$$\text{Volume} = \frac{10 \times 231}{0.9150 \times 8.3356} = 302.9 \text{ cubic inches.}$$

Where the volume of one gallon = 231 cubic inches, or basing on the weight of a cubic foot of water at 62 degrees F., which is 62.355 pounds,

$$\text{Volume} = \frac{10 \times 1728}{62.355 \times 0.9150} = 302.9 \text{ cubic inches.}$$

NEW BOOKS

Standard Seamanship for the Merchant Marine Service. By Captain Felix Riesenberg, C. E. Master Mariner in sail and steam. Size, 6 by 9 inches. Pages, 942. Profusely illustrated. New York, 1922: D. Van Nostrand Company.

This book is a very thorough work on the art of seamanship, covering not only the management of all types of vessels but giving a clear description and definitions of the different classes of ships, their construction and equipment. To present a book of this kind, an author must have a long practical experience on both sail and steam vessels. For this reason there are very few books on seamanship as compared with the works on navigation. The art has been passed along by word of mouth by those who have become expert in the knowledge of the sea by actual physical contact with its forces.

Captain Riesenberg, however, is a good seaman as well as an interesting writer and, still further, he acknowledges a long list of prominent marine men from whom he has drawn material for his work.

While the book will be interesting to anyone who likes the sea, it should be a great help to the ambitious sailor whether he be employed on the deck or in the engine room. One of the author's objects is to give the engine room force a clear idea of the management of a vessel and, at the same time, to give the man on deck a general knowledge of the engine room.

The principal value of this work lies in the opportunity it gives to the officer or sailor to use his spare time in perfecting his knowledge in the management of ships. When safety depends, as it does on shipboard, on incessant attention to manifold details, it is of the highest importance that those who have the ambition to command should have complete knowledge of their vessel and every piece of equipment on it. They should not only know but they should also have the ability to quickly apply their knowledge; for in times of emergency the question of safety or disaster often depends on instant action.

The diagrams and illustrations of equipment and fittings are particularly good and they should enable a quick grasp of the subject by the reader. Rules are given in a systematic manner covering the handling of a ship and the regulations required by the navigation laws. Ropes, block and tackle, stowage, boats, compasses, leads, logs, ground tackle, maintenance, weather and many other subjects are treated at length.

The Mathematics of Navigation

Reviewed by Charles E. Manierre

The Mathematics of Navigation. By Edward J. Willis, M. E. Size, 5⅜ by 8 inches. Pages, 38. Illustrations, 19. Richmond, Va., 1921: J. W. Fergusson and Sons.

This volume will interest those who are students of the science of navigation. It is also a book which astronomers will want in their libraries and which will appeal to engineers concerned with geodetic surveying. Much of its contents is quite new and cannot be found elsewhere. It has already received favorable comment from competent authorities in the United States and in all the large maritime countries of Europe; it has been approved as a reference book in Chinese nautical schools, and a German translation is now in process of publication and will soon appear on the list of Echardt & Messtroff, Hamburg.

The author has approached his subject by way of the calculus instead of by the usual methods of spherical geometry and trigonometry. This may account for his finding several new and useful equations. His position is that while it is necessary to work to five places of decimals to obtain an accurate position, it is only necessary to work to three places to correct an approximate position. His method for difference hour angle and difference latitude enables him to use a 20-inch slide rule as a substitute for much work now done by logarithmic tables.

As an example of the novelty of his methods, he describes a circle about the St. Hilaire assumed position, using difference altitude as a radius and locating the Sumner line as tangent to this circle and through a point determined as a difference longitude. Incidentally he develops a substantially new equation for the cotangent of the azimuth as an excellent substitute for the first and second of Napier's Analogies as used in Section 352 of Bowditch. It is true that Muir uses this equation in a somewhat different form for a different purpose though he did not develop it to this particularly useful result.

Mr. Willis has also found a rearrangement of the sin cos St. Hilaire problem in which the hour angle is the unknown quantity. This permits an excellent substitute for the usual chronometer error problem and for the long used sin cos longitude problem, and suggests a similar problem for the cosine of the azimuth, with altitude, declination and latitude as the known quantities. It is a form of equation which may be used in navigation and in other spherical trigonometry work for finding all unknown angles when three sides are given. There is also a new equation for cosine of the azimuth, particularly useful when the object is nearly east or west. Great circle sailing, the Mercator chart and a fix by simultaneous observations are all treated in a novel manner in a few pages which bring the book to its conclusion.

The propositions are clearly stated and the book is also unusual in its brevity. It is decidedly a case of quality and not quantity. The book will repay abundantly the study of those who nevertheless do not themselves contemplate making a change in their own form of working. On the other hand, anyone of sufficient mathematical training, who is in the habit of using daily the slide rule and Crelle's tables in solving other problems and who does not look with favor on logarithms, can adopt the method of the author with a minimum of effort.

PERSONAL MENTION

HUGH MACKENZIE, assistant general passenger agent of the Pacific Steamship Company since 1916, has been promoted to the newly created office of general passenger agent of this company.

J. J. EASON, formerly in charge of the repair department of the Shipping Board, is now associated with the Globe Marine Compositions Company, Inc., ship painters and manufacturers.

A. G. JACKSON has been transferred from the traffic department of the Shipping Board in Washington to take charge of Mediterranean and European affairs in New York, succeeding W. L. Bull.

REAR ADMIRAL J. D. BEURET, U. S. N., has been named by President Harding to succeed Rear Admiral D. W. Taylor, who recently resigned as chief constructor of the Navy. Admiral Beuret entered the service as a naval cadet in 1888 and graduated from the engineering division of the Navy in 1892. From October 1892 until December 1895 he studied at the Ecole des Mines and Ecole du Genie Maritime, Paris, and from this time until July, 1899, served as an assistant in the department of construction and repair at Mare Island Navy Yard. Leaving this post he became assistant to the superintending constructor at the Union Iron Works and remained here until July, 1901. For the next few years he held various posts in charge of the work of the bureau of construction and repair, becoming construction officer at the Navy Yard, Boston, in 1911. He held the position of inspector of hull material of the eastern district until May, 1913, following this with special duty in the department of justice. From December, 1914, until October, 1920, he was on the staff of the bureau of construction and repair and from then, until assuming his duties as chief of the bureau, was construction officer at the Mare Island Navy Yard.

Rear Admiral J. D. Beuret

HENRY J. MILLER was unanimously elected president of the Lake Torpedo Boat Company, Bridgeport, Conn., by the board of directors to fill the vacancy caused by the death of his brother, Herbert S. Miller.

W. L. BULL, head of the European and Mediterranean trades of the Emergency Fleet Corporation, has returned to the Mallory Transport Lines, having completed the special work undertaken for the Shipping Board.

GEORGE F. HILL has been appointed general agent of the North Atlantic and Western Steamship Company. Mr. Hill was formerly affiliated with the Erie Railroad at New York and later with the Norton Company of Worcester, Mass.

ANGUS MARSHALL, formerly general superintendent of the Alabama Dry Dock and Shipbuilding Company, Mobile, Ala., has resigned his position with this company to become vice-president and general manager of the Todd Shipbuilding and Dry Dock Company, Mobile, Ala. For 13 years prior to his association with the Alabama Dry Dock Company he acted as marine superintendent for the Texas Company and more recently as assistant manager of their shipbuilding plant at Bath, Me.

MEYER LISSNER, of Los Angeles, Cal., has been reappointed as a Pacific Coast representative of the Shipping Board. Mr. Lissner was born in San Francisco in 1871, received his education in the public schools at Oakland, Cal., and graduated from the Los Angeles Law School in 1899. Since 1899, until the new Shipping Board was formed last year, he was engaged in the practice of law in Los Angeles. In 1907, Mr. Lissner organized the Los Angeles City Club and was its president in 1911. He was president of the Good Government Organization and chairman of the First Board of Public Utilities in Los Angeles in 1909. He was also active in organizing the reform movement in California in 1910 and was chairman of the State Central Committee in that year. Mr. Lissner has always maintained an active interest in California's public service and was a delegate to the National Committees in 1912 and 1920. From 1914 to 1918 he was editor of the *California Outlook* and from 1916 to 1920 a member of the California Industrial Accident Commission. In 1921, on the formation of the new Shipping Board, he was appointed as a Pacific Coast representative.

Meyer Lissner

REAR ADMIRAL W. S. BENSON, U. S. N. (retired), former chairman of the United States Shipping Board, has been reappointed by President Harding as one of the Atlantic Coast representatives of the Shipping Board. Born in Bibb county, Georgia, in 1855, Rear Admiral Benson was graduated from the Naval Academy in 1877. In 1879 he was commissioned a midshipman and served on the *Constitution* for two years. In 1881 he was made an ensign and commissioned through succeeding grades to the rank of admiral (chief of naval operations), in 1916. Admiral Benson has served as commanding officer of several of the first class dreadnoughts and at one time was chief of staff of the Pacific fleet. From 1907 to 1908 he served as commandant at the Naval Academy and was commandant of the Philadelphia Navy Yard and supervisor of the third, fourth and fifth naval districts from August 1913 until April 1915, when he was assigned to duty as chief of naval operations. In the latter part of 1917, he was assigned to duty in London, after which he returned to the United States and remained until assigned to special duty in Paris. He remained abroad until June, 1919. In the following year, he was elected chairman of the Shipping Board for the unexpired term of John Barton

Rear Admiral W. S. Benson

Payne, who resigned to become Secretary of the Interior. Upon the formation of the new Shipping Board last year, Admiral Benson was appointed as a representative from the Atlantic Coast district.

W. L. Martignoni is representing Messrs. Pillsbury and Curtis, the naval architects of San Francisco, at the Sun Shipbuilding Company's yard where the passenger liner is being built for the Inter-Island Steam Navigation Company.

Captain W. A. Hindon has been made port captain of the United States Shipping Board, port of Boston, to relieve Captain John J. Coholon, resigned. During the war, Captain Hindon was on the staff of the commandant at the Hampton Roads Naval Base and also served as executive officer on several navy transports.

Arthur Stout has been made assistant to the general manager of the Todd Shipbuilding and Dry Dock Company's new plant at Mobile, Ala. Mr. Stout was formerly assistant general superintendent of the Alabama Dry Dock and Shipbuilding Company of Mobile and before this was with the United States Shipping Board, the Johnson Iron Works of New Orleans and the Marine Iron Works of Chicago.

Captain George F. Cooper, U. S. N. (retired), has joined the staff of Uttmarks Nautical Academy of New York and Boston. Captain Cooper will be in charge of the Boston school to relieve Captain L. Wessel. Captain Cooper had command of the U. S. S. *Louisiana* and was executive officer of the U. S. S. *Rhode Island* when these vessels were the "pride of the Navy." During the war, Captain Cooper was in command of several transports and later commandant of the eighth Naval District, the United States Naval Training Base and other activities at New Orleans.

Nathan A. Smyth, general counsel of the United States Shipping Board Emergency Fleet Corporation, recently resigned. Mr. Smyth joined the Emergency Fleet Corporation in July, 1921, intending to remain until January, 1922, but owing to the enormous amount of work on hand, decided to remain for another six months. Mr. Smyth was born in Quincy, Ill., but received his early education in New Haven, Conn. He graduated from Yale University in 1897 and from the Yale Law School in 1900. In 1901 he was admitted to the New York bar and has practiced in that state since that time. From 1902 to 1909 he was assistant district attorney of New York. During and immediately after the war he was assistant director general of the United States Employment Service Bureau, returning from this position to private practice. He was again called into the service of the Emergency Fleet Corporation as general counsel in 1921.

Joseph W. Powell, who recently resigned from the position of president of the United States Shipping Board, Emergency Fleet Corporation, has been elected a member of the board of governors of the Maritime Association, Boston Chamber of Commerce. Mr. Powell is generally regarded as one of the leading authorities of this country in shipbuilding and marine engineering. A graduate of the United States Naval Academy at Annapolis, Mr. Powell left the Navy after a few years' service to take up ship construction. He had charge of the Fore River Yard of the Bethlehem Shipbuilding Corporation and during the world war was elected vice-president of the corporation and organized and supervised all of the Bethlehem Corporation's shipbuilding operations. At the close of the war, Mr. Powell was called to Washington and accepted the position of president of the Shipping Board Emergency Fleet Corporation, serving in that executive capacity for a period of six months. Mr. Powell is deeply interested in the efforts being made to increase the business of the port of Boston and the other New England ports and as a member of the governing board will co-operate with the Maritime Association in its efforts to upbuild and increase New England's foreign trade through its own ports.

Sanford H. E. Freund, special counsel in charge of contracts, opinions, and recoveries of the United States Shipping Board has been appointed to succeed Nathan A. Smyth, general counsel for the Emergency Fleet Corporation, who recently resigned. Mr. Freund graduated from Harvard College in 1901 and from the Harvard Law School in 1903. Upon leaving the university, he became a member of the firm of Saltonstall, Dodge & Carter, attorneys at Boston where he remained until 1910, when he was appointed eastern attorney of the Chicago, Rock Island and Pacific Railroad Company. In 1912 he was chosen assistant general counsel for the Great Northern Railway Company and served in this capacity until 1918 when he entered the services of the Government as director of the clearance division, United States Employment Service. He left this position in 1919 to become assistant general counsel of the United States Railroad Administration, and later joined the legal staff of the Emergency Fleet Corporation.

OBITUARY

A. J. Frey, of Los Angeles, Cal., vice-president of the United States Shipping Board Emergency Fleet Corporation in charge of physical operations, died at the Johns Hopkins Hospital, Baltimore, Md., on June 13. Mr. Frey was one of the greatest ship operating organizers that the country has ever produced and Albert D. Lasker, chairman of the Shipping Board, when notified of his death, stated that the best work of the Board has been done in physical operations during the period that Mr. Frey was on active duty. For sixteen years prior to 1918 Mr. Frey was with the Pacific Mail Steamship Company, for the last eight years of which term he was assistant general manager. In May, 1918, he joined the United States Shipping Board Emergency Fleet Corporation at San Francisco and succeeded District Manager Pillsbury in charge of the ship construction division of the southern Pacific district. This position he held until July, 1920, when he entered the service of the Los Angeles Steamship Company as general manager. He resigned from this position in order to become associated with the Shipping Board. He was later made vice-president of the Emergency Fleet Corporation and continued in active charge of operations until he succumbed to the sickness which resulted in his death.

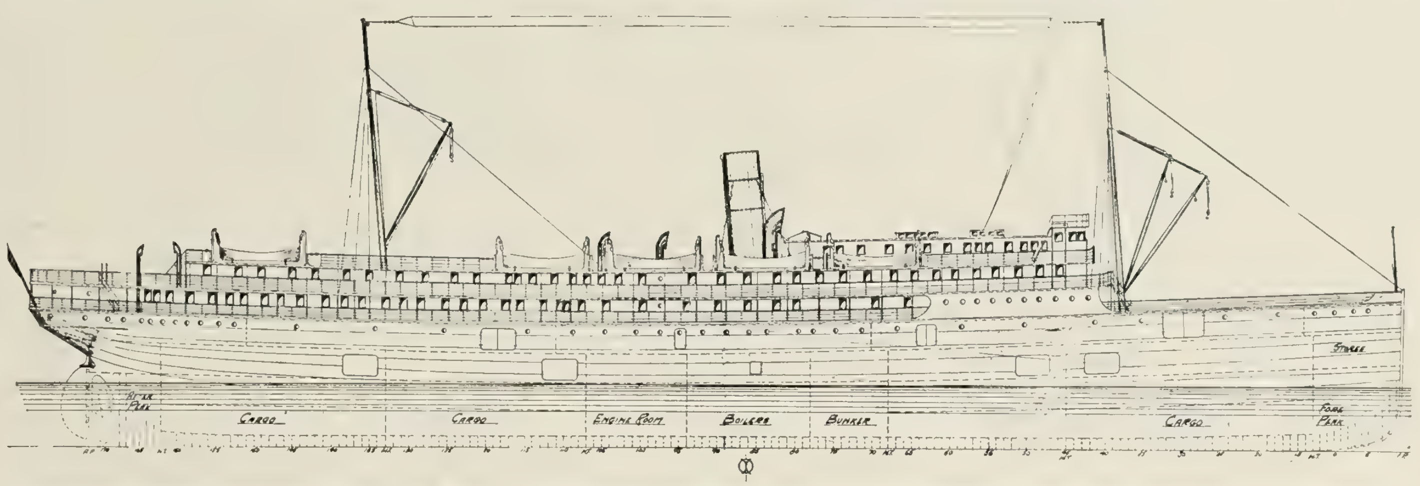

A. J. Frey

Herbert S. Miller, president of the Lake Torpedo Boat Company, Bridgeport, Conn., died recently at his home in Bridgeport.

Sir Ernest Manifold, Raeburn, K. B. E., who succeeded Sir Ashley Sparks as director general in this country of the British Ministry of Shipping, died in New York on June 1. His work here was the settlement of counter claims between the Shipping Board and the British Government as a result of the world war.

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry



Outboard Profile Showing Type of Ship to be Contracted For By The Savannah Line For Atlantic Coast Service

Ocean Steamship Company, Savannah Line, Issues Plans and Specifications for Two Passenger and Freighters

Vessels Will Be Built of Steel, Driven by Reciprocating Engines Turning Single Screws—To Accommodate About 228 Passengers—Bids June 29

THE Ocean Steamship Company, of Savannah, E. R. Richardson, vice-president and general manager, Pier 35, North River, New York City, received bids for the construction and delivery of two steel, single screw combination freight and passenger steamships, until 12 o'clock noon (Daylight Saving Time), on June 29, to be opened at 3 P. M. on the same date. It is expected that the ships will cost approximately $1,000,000 each. The first ship is deliverable September 1, 1923, and the second ship, October 1, 1923. The vessels are to be similar in type to the company's steamers *City of St. Louis* and *City of Montgomery*.

DIMENSIONS

The specifications provide for a ship having an overall length of about 400 feet, length between perpendiculars 382 feet, beam molded 52 feet, depth molded to hurricane deck 35 feet, depth molded to main deck 27 feet, depth molded to lower deck 18 feet 6 inches, depth molded to orlop deck 10 feet 6 inches, load draft with 3,500 gross tons deadweight including cargo, coal, passengers, crew and stores, about 18 feet 6 inches. Maintained sea speed, loaded, not less than 12½ knots.

GENERAL DESCRIPTION

The vessel will be a steel hull, single screw, passenger and freight ship of the hurricane deck type, being schooner rigged with two steel pole masts. There will be a complete steel orlop deck in the cargo holds, steel upper between deck, steel main deck, steel hurricane deck, wood promenade deck and wood boat deck.

The propelling machinery will be an inverted, direct acting, triple expansion, surface condensing engine, having cylinders 26 inches, 43 inches and 72 inches diameter by 48-inch stroke with a working steam pressure of 200 pounds and the engine designed to develop 2,900 indicated horsepower at not exceeding 75 revolutions per minute. The air and two bilge pumps will be worked from the crosshead to the main engine, the other pumps to be independent.

BOILERS

There will be four, single-ended cylindrical return tube type main boilers, 14 feet 9 inches diameter by 11 feet 6 inches long, fitted for burning coal under natural draft. Diamond flue blowers and connections will be installed on all four main boilers.

CONDENSER

The condenser will be of the independent circular type. There will be about 4,100 square feet of cooling surface, the tubes to be of brass ¾-inch outside diameter by 17 BWG thick and the tube plates of rolled brass 1-inch thick. The propeller will be a right-hand true screw of about 16 feet diameter with cast iron hub and four manganese bronze blades.

ENGINE ROOM EQUIPMENT

The feed water heater will be of the Reilly multicoil type of sufficient size for heating the feed water to a minimum temperature of 200 degrees F. and two spare coils will be furnished.

(*Continued on page* 464)

Quarter Million Dollar Job Awarded To Dravo Co.

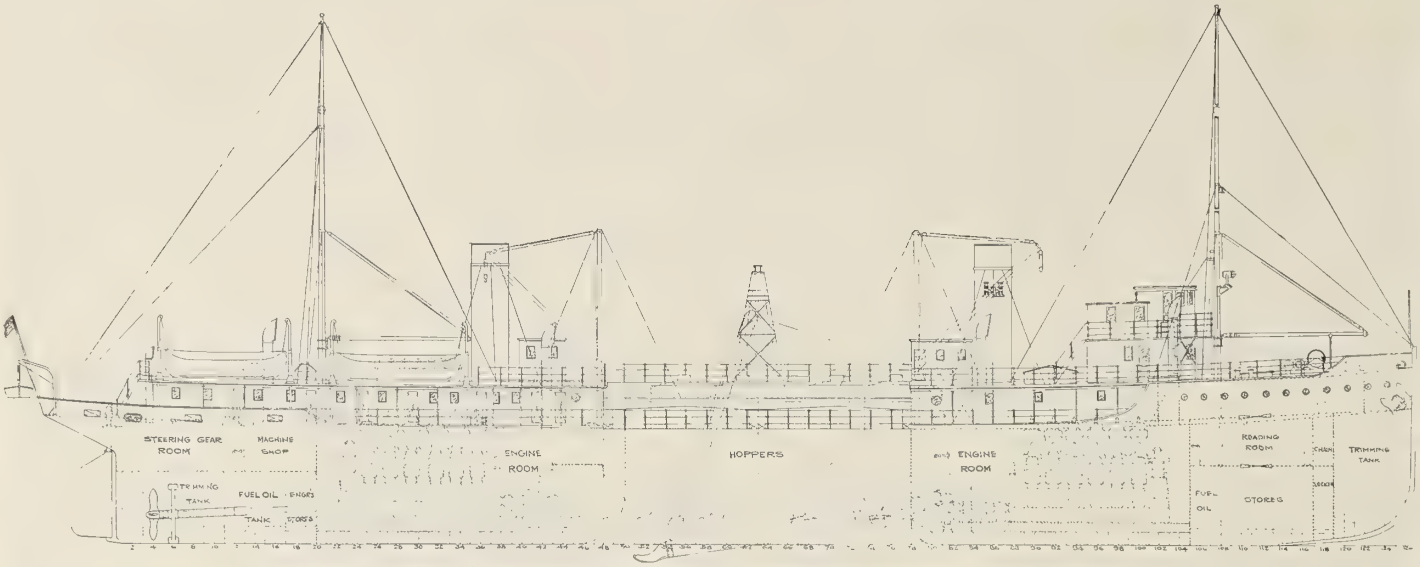
The Dravo Contracting Company has been awarded a contract by the Gulf Coast Lines, covering the design and construction of a new car transfer steamer, to be named *G. H. Walker*, at a cost of $250,000. The steamer will be constructed to handle complete train service between Mexico and the Southwest, and New Orleans and the East, across the Mississippi River, between Anchorage, La., and Baton Rouge, La.

The *G. H. Walker* will have a molded length of 340 feet, beam over guards of 90 feet, molded beam of 56 feet, depth of 11 feet, and will be of steel construction throughout. Complete trains will be handled by the boat at a single crossing. The Dravo Contracting Company plans to complete the boat on its Neville Island docks and send it South under its own steam, by way of the Ohio and Mississippi Rivers. It is intended to ship a cargo of 2,000 tons of steel products to New Orleans on her.

Two Stern Wheel Tugs Are Being Designed By New York Architects

PLANS and specifications are being prepared by Cox and Stevens, naval architects, New York, for a shallow draft stern wheel river towboat. The principal dimensions are: Length over all, 90 feet; beam, 20 feet and depth 4 feet. The propelling machinery consists of a 200-horsepower C. O. engine having a double roller chain drive and reduction gear. This boat is for the Kelley Axe Manufacturing Company of Charleston, W. Va.

A similar towboat, fitted with a 60-horsepower engine for the Peoria Grain and Barging Company of Springfield, Ill., is also being designed by Cox and Stevens. This boat is for service on the Illinois river.



Outboard Profile of Diesel-Electric Hopper Dredges to Be Built for Government

Three Million Dollars to Be Spent for Construction of Four Diesel-Electric Seagoing Dredges

War Department Issuing Plans and Specifications for 268-Foot Ships of Modern Design and Equipment—Will Have Capacity of 1,250 Cubic Yards—Bids Open August 2

The engineers of the war department, Washington, D. C., have prepared plans and specifications for the construction of four Diesel-electric, seagoing hopper dredges, each having a capacity of 1,250 cubic yards and which, it is expected, will have a total cost of approximately $3,000,000 to $3,250,000.

The specifications and plans will probably be in the hands of bidders by June 29 and the bids are to be opened August 2. The ships are to have an overall length of 268 feet 5 inches, length between perpendiculars 254 feet, beam molded 46 feet, depth 22 feet 6 inches, draft loaded 19 feet 6 inches, speed 11½ knots.

Propulsion

Each vessel will be equipped with three engines of the McIntosh & Seymour type of 1,000 brake horsepower on the four-cycle system. The engines will be direct-connected to 700 kilowatt generators for both propelling and dredging. They will produce a direct current of 500 volts. The two propulsion motors for the twin screws will develop 800 horsepower. They will run between 90 and 110 revolutions per minute on direct current and will be fully enclosed.

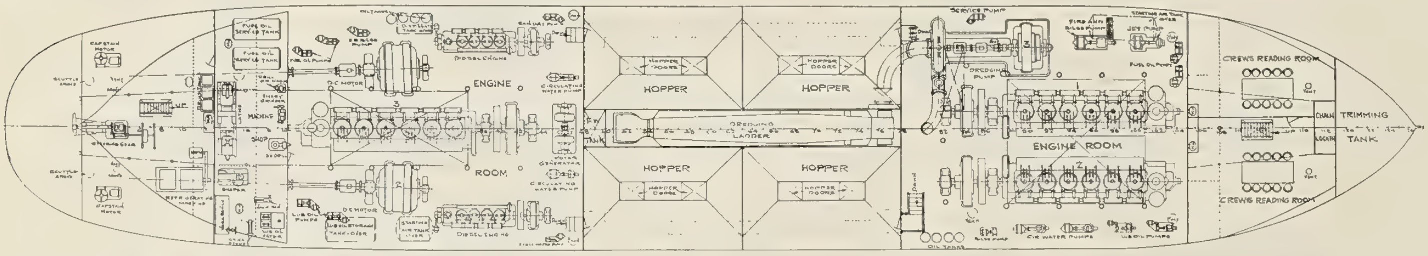
The dredging motor will develop 750 horsepower at 150 revolutions per minute and it will be directly connected to a 26-inch volute centrifugal, single suction, dredging pump.

Electric Control Throughout

The Ward-Leonard system of electric control will be installed so that the engines may be worked either from the pilot house or the engine room. It is thought that in actual use the engines will probably be controlled from the pilot house when dredging and in the engine room when the vessel is being navigated.

Approximate Cost

It is expected that the cost of these ships will range from approximately $750,000 to $800,000 each.



Hold Plan of Hopper Dredge Showing General Arrangement of Propelling Machinery and Auxiliaries

Ocean Steamship Company, Savannah, Issues Specifications

(*Continued from page* 463)

There will be two bilge pumps, 3 inches diameter by 21-inch stroke, one fitted at each side of the air pump. There will be two 2½-inch Metropolitan double-tube injectors and one auxiliary surface condenser consisting of not less than 450 square feet of cooling surface to be fitted with an independent, direct-acting, combined air and circulating pump. Steam pumps will include two feed pumps, 14 inches diameter steam cylinder, 9-inch diameter water cylinder, 24-inch stroke; two fire and bilge and ash ejector pumps, size 12 inches by 8½ inches by 12 inches, of the vertical duplex type; one ballast pump, size 7½ inches by 9 inches by 10 inches; one sanitary pump, size 12 inches by 8½ inches by 12 inches; one fresh water pump, size 6 inches by 6 inches by 6 inches and the main circulating pump will be of the centrifugal double suction type, 14-inch suction, driven by an independent, direct-acting, single cylinder engine, 8 inches diameter by 10-inch stroke. Two ash ejectors will be fitted in the fireroom, one on the port side and one on the starboard side.

There will also be one 4-ton service one one 4-ton spare refrigerating machine of the Brunswick or equal type on the ammonia brine system.

On the promenade deck there will be 40 rooms with 16 beds, 64 berths, accommodating a total of 80 passengers.

On the hurricane deck there will be 42 rooms with 4 beds, 80 berths, accommodating 84 passengers, making the total first-class passengers 164.

On the hurricane deck there will be 12 rooms with 24 berths, accommodating 24 passengers.

On the main deck there will be 8 rooms with 16 berths, accommodating 16 passengers, making the total number of second-class passengers 40.

Tenders Received For Three Freighters To Enter Coast Route

A REQUEST for bids for the construction of one, two and possibly three coastwise freighters for the Eastern Steamship Lines, Inc., of Boston, Mass., was recently sent to several shipyards on the east coast. The plans and specifications were prepared by Theodore E. Ferris, naval architect, 30 Church street, New York City, and bids were scheduled for opening on Wednesday, June 14. It is believed the ships will cost close to $300,000 each. They will be built of steel and driven by reciprocating engines turning a single screw.

Type and Dimensions

The ships will be of the hurricane shelter deck type having an overall length of 233 feet 3 inches; length between perpendiculars 221 feet 6 inches; beam molded, 38 feet; load draft, 17 feet; 1,400 deadweight tons and developing a speed of 11½ knots. The vessels will be schooner rigged having two steel pole masts with cargo derricks. There will be four hatches, four steel bulkheads and complete double bottom.

Propelling Machinery

The propelling machinery will consist of one triple expansion engine, 17 by 28½ by 48 by 36-inch stroke, developing 1,100 indicated horsepower, turning a single, four-bladed propeller at 98 revolutions per minute.

Boilers

Steam will be supplied by two oil burning, single ended Scotch boilers fitted with heated forced draft. The boilers will be of the two-furnace type, 11 feet 6 inches inside diameter, 11 feet long, having 2,972 square feet of heating surface and delivering steam at 190 pounds working pressure.

Engine Room

The engine room equipment will include one main condenser having 1,875 square feet of condensing surface, one main circulating pump of the centrifugal type with about 8-inch suction; one main air pump, one auxiliary feed pump, one fire, bilge and general service pump, one sanitary pump, one ballast pump, one fresh water pump, one scuttle butt circulating pump, one ice machine condenser circulator pump, two oil service pumps, one oil transfer pump, one feed water heater to handle 20,000 pounds of water and one 2-inch injector.

Plans and Specifications Out for Steel Freighter

Plans and specifications have been issued for the construction of a steel freight steamer for the Catskill Evening Line to run between New York and Hudson River points. It is understood that bids are to be received by J. W. Millard & Bro., naval architects of 17 State street, New York, who designed the vessel and drew the specifications, until July 15, 1922, decision on the contract to be reached probably by August 15.

The boat will be 192 feet extreme length, having a beam molded at deck of 40 feet 4 inches. She will be driven by a triple expansion reciprocating engine, steam being supplied at 180 pounds working pressure, by a coal burning single ended Scotch boiler.

$491,904 Is Low Tender for Construction of Twelve Sea Scows For New York Street Department

WITH a unit price of $40,992 and a total of $491,904 for 12 boats, W. H. Gahagain Company, of Brooklyn, N. Y., was low bidder for the construction of side dumper sea scows for the City of New York at the opening of bids by the Board of Purchase in Room 526, Municipal Building, Manhattan, on Monday, June 5. The bids submitted were as follows:

The specifications provide for a side dumper scow, length inside fenders 134 feet; breadth outside to outside of side planks 37 feet; depth molded to center, top of deck plank to bottom of bottom plank 14 feet; depth at sides, top of deck plank to bottom of bottom plank is 13 feet 8 inches; completely equipped for use by the Department of Street Cleaning.

	Unit Price	Total Price
W. H. Gahagain, Brooklyn	$40,992.00	$491,904
Atlantic Gulf & Pacific Co	44,491.67	533,900
Merchant Shipbuilding Corp.	49,000.00	588,000
Gildersleeve Shipbuilding Co.	60,000.00	180,000 (Total for three)

American Shipyards Building 208,310 Tons on June 1

Steel tonnage under construction and contracted for in the United States on June 1 this year totaled 122 vessels aggregating 208,310 tons, according to the American Bureau of Shipping.

Of this tonnage, the records of the bureau show, 20 ships of 155,205 tons are of the seagoing type and 102 vessels aggregating 53,105 tons are non-seagoing, including tugs, ferryboats, car floats, yachts, etc. This work is shown to be well scattered over practically all of the yards of the North Atlantic coast and the Great Lakes.

The bureau reports work contracted for and under way on June 1 as follows:

Yard.	Seagoing. Craft.	Seagoing. Tons.	Non-seagoing. Craft.	Non-seagoing. Tons.
American Bridge Co	..	......	19	5,950
American S. B. Co	*3	25,500	..	....
Amer. Car & Fdry	..	......	3	1,500
Atl., Gulf & Pac. Co	..	......	1	1,200
Beth. S. B. Corp., Ltd.—				
Balt. D. D. plant	..	......	3	2,100
Harlan plant	..	......	1	....
Sparrows Point plant	2	27,000	..	....
Alameda plant	2	27,000	3	3,600
Consol. S. B. Corp	..	......	3	1,425
Doullut & Williams S.B.	..	......	1	450
Dravo Contracting Co	..	......	23	7,180
Eichlaey, John, Jr	..	......	4	1,700
Federal S. B. Co	3	16,000	3	2,850
Great Lakes Eng. W'ks.	*1	6,585	...	....
Kyle & Purdy	..	......	3	1,220
Los Angeles S.B. & D.D.	..	......	2	2,400
Manitowoc S. B. Co	*1	4,900	..	....
Marietta Mfg. Co	..	......	2	900
Merchant S. B. Corp	1	7,800	..	....
Midland Barge Co	..	......	8	4,750
Newp't News S. B. Co.	..	......	1	....
New York S. B. Corp.	2	13,600	..	....
Pusey & Jones Co	2	5,420	..	....
Riter Conley Mfg. Co	..	......	10	4,300
Staten Isld. S.B. Corp.	..	......	5	5,380
Sun S. B. Corp	2	13,000	..	....
Toledo S.B. Co	*1	8,400	*1	1,500
Ward, Charles	..	......	3	2,600
Wm. Cramp	..	......	3	2,100
Total	20	155,205	102	53,105

* For Great Lakes.

Bids Asked for Construction of Steel Maneuver Boat Hull

Sealed proposals in duplicate for furnishing and delivering a steel maneuver boat hull for dam No. 1, Levisa Fork, of the Big Sand River, will be received at United States Engineer Office, Room 415, Custom House, Cincinnati, Ohio, until July 1, 1922, and at the United States Engineer Office, 1122½ Fourth avenue, Huntington, West Virginia, July 1, 1922, and thereafter until 10 A. M. (central standard time), July 10, 1922. Prospective bidders may obtain blue prints upon application.

Eight Hulls Building at Yard of Federal Shipbuilding Company

The Federal Shipbuilding Company, of Kearny, New Jersey, announces the moving of its general sales offices from 71 Broadway to 26 Beaver Street, New York City.

Contracts at the Federal yard at present include the following:

Hull No. 68—1 10,000 deadweight tonnage steel freight steamer, length 425 feet, beam 56 feet, depth 30 feet.

Hull Nos. 69-70—2 steel oil barges for Gulf Refining Company, length 158 feet, beam 37 feet, depth 11 feet 6½ inches.

Hull No. 71—1 steel drill boat for War Department, sub-contract from Dravo Contracting Company, length 157 feet, beam 52 feet, depth 12 feet 9 inches.

Hull Nos. 72-73—2 steel passenger and freight steamers for Merchants & Miners Transportation Company, length 350 feet, beam 52 feet, depth 27 feet 3 inches.

Hull Nos. 74-75—2 steel car floats for the Long Island Railroad, length 292 feet, beam 43 feet 8 inches, depth 11 feet 6 inches.

Military Ceremonies Mark Renaming of Madawaska to U. S. Grant

When the *Madawaska* was lowered from the 30,000-ton floating drydock at the plant of the Morse Dry Dock Company, Brooklyn, N. Y., June 3, General Grant's granddaughter, Princess Cantacuzens, Countess Speransky, renamed the vessel the *U. S. Grant.* The Secretary of War, John W. Weeks, the Assistant Secretary of the Navy, Colonel Theodore Roosevelt, General Robert E. Bullard and staff from Governor's Island, Colonel L. H. Pash, Colonel W. H. Hart and Colonel E. A. Simmons were among the officers who attended the ceremony. A company of infantry was also present and music was furnished by an army band. Colonel Pash acted as master of ceremonies.

The *Madawaska*, which has been reconditioned for the Army Transport Service, on the trans-Pacific run, is a vessel of 9,410 gross tons. She is 490 feet long, 45 feet beam and has a depth of 31.1 feet. She has been refitted with watertube boilers of the Babcock and Wilcox type and a complete new refrigeration system installed.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Repairs to Damaged Steamer, Portland.—The schooner Ecola recently went on a Portland drydock for repairs.

Freighter Cleaned and Painted.—The Sailer, freighter of Java Pacific Line, drydocked for cleaning and painting.

Steamer Construction, Baltimore, Md.—Weems-Williams Line, Baltimore, Maryland, to build combination passenger and cargo steamer.

Miscellaneous Repairs, Chester, Pa.—The Innoko, American steamship, was placed in drydock for miscellaneous repairs at Sun Shipbuilding Company, Chester, Pa.

Coast Guard Cutter Overhauled, Seattle, Wash.—U. S. coast guard cutter Arcata underwent general overhauling at Seattle, after which she returned to her station.

Norwegian Steamer Repaired, San Francisco, Calif.—Steamer Niels Nielsen, Norwegian vessel, after arriving at San Francisco from the Orient, was drydocked for repairs.

Motorship Drydocked, Seattle, Wash.—The motorship Kennecott, in the service of the Williams Steamship Company, went to Seattle, Wash., to be drydocked before loading at Tacoma.

Steamer Taken from Layup, Boston, Mass.—Boston floating hospital, laid up for winter at Charlestown bridge, was moved to Atlantic Works, East Boston, for scaling and painting.

Contract Award, Portland, Ore.—Lowest bid for repairs to Iowan, reported in collision with Welsh Prince, was $53,500, with no delivery time guaranteed; contract awarded on bid of $57,000.

Repairs to Steamer, Mobile, Ala.—The contract for repairs to the American steamer Nyanza, now at Pinto Island, was awarded to the Alabama Dry Dock Company, repairs to cost about $45,000.

Tanker Repairs, Chester, Pa.—Tanker J. W. Van Dyke, of Atlantic Refining Company, was drydocked at Chester, Pa., at Sun Shipbuilding Company's yards.

Miscellaneous Repairs, San Francisco, Cal.—Pacific Mail liner Golden State was awarded to Moore Shipbuilding Company, having submitted lowest bid.

Schoolship Drydocked.—United States steamship Newport, schoolship of the New York State Nautical School, was drydocked preparatory for its annual cruise.

Conversion to Suction Dredge, East Boston, Mass.—Extensive alterations to whaleback steamer Bay View, to convert to suction dredge, were made at Simpson's Drydock in East Boston. Vessel has been sold to Cleveland interests and will return to lakes.

Barge Launched, Hoquiam, Wash.—Largest lumber barge ever built on harbor at Hoquiam, Wash., was launched at Shilman Shipyard for fleet of W. R. Osborn, Aberdeen. It has capacity of 150,000 feet and fleet operated by Osborn can now handle 1,500,000 feet.

Conversion to Oil Burner, Mobile, Ala.—The Nika, wooden steamer purchased at Mobile by F. M. Stark, of San Francisco, converted to oil burner and placed in Pacific coastwise lumber trade. Mr. Stark is negotiating for purchase of another wooden ship for same business.

Repairs to Steamer, New Orleans, La.—Marine Iron Works was awarded contract for making necessary repairs to Swedish steamship Italia of New Orleans & South America Company. President Walker, of Marine Iron Works, superintended all general repairs and overhauling required.

Steamers Repaired, Newport News, Va.—Famous old James river steamers Brandon and Berkeley, for years operated between Norfolk and Richmond by Old Dominion Steamship Company and idle for last two years, have been sold to New York-Cape May Steamship Company. Boats to be repaired before going into service.

Construction Considered, New York.—Clyde Line has under serious consideration construction of two new cargo and passenger ships, service from New York to Charleston and Jacksonville. Vessels probably to be similar to company's steamship Lenape, about 425 feet long, driven by turbine engines, speed about 15 knots.

Vessel Conversion, Hoboken, N. J.—Standard Oil tanker Montrolite converted at Tietjen & Lang plant of Todd Shipyards Corporation, Hoboken, New Jersey, from a turbine to reciprocating engined ship. Steamship L. J. Drake of same company was also at the yard undergoing similar conversion. Estimated total cost for both, $100,000.

Ferryboat Launched, New York.—The ferryboat Poughkeepsie, for the Poughkeepsie-Highlands run, was launched Monday, May 29, from the ways of the Mill Basin Shipyard of the Atlantic, Gulf & Pacific Company, at Jamaica Bay. Her dimensions are: length, overall, 140 feet; beam, over guards, 52 feet; draft, at launching, 8 feet 3 inches; draft, loaded, 9 feet 6 inches.

Contracts Placed, Southern Yards.—United States steamship Johancy was sent to plant of Newport News Shipbuilding and Dry Dock Company; the Meanticut, to Warwick Machine Company; the Braddock, to Newport News Iron Works; the Hinckley, to Southern Shipyard; and Eastern Crown to the Newport News Shipbuilding and Dry Dock Company.

Twenty-seven Hulls Under Construction, Pittsburgh, Pa.—Twenty-seven hulls, having total of 5,477 gross tons, are under construction by Dravo Contracting Company, of Pittsburgh, Pa. List includes four steel sand and gravel barges of 320 tons each, three steel cargo barges of 215 tons each and four steel cargo barges of 135 tons each, awarded the company in April.

Motor Yacht Sold, New York.—Motor yacht Sachem was sold by A. M. Andrews, of New York, to Harry S. Leyman, of Cincinnati, Ohio. Vessel is a 90-footer and was fitted out at Tebo Yacht and Basin Company of Todd Shipyards Corporation. The transaction and incidental work were handled by Henry J. Gielow, Inc., naval architects and marine engineers of New York City.

Car Transfer Steamer Construction, Pittsburgh, Pa.—Dravo Contracting Company was awarded contract by Gulf Coast Lines, covering design and construction of new car transfer steamer, to be named G. H. Walker, at cost of $250,000. The vessel will have molded length of 340 feet, beam over guards of 90 feet, molded beam of 56 feet, depth of 11 feet, and of steel construction throughout.

Shipyard Activities, West Coast.—The Logan, army transport, was placed on Hunters Point drydock for general repairs, cleaning and painting; the Everett, of C. R. McCormick Company, went on Bethlehem ways; Dutch steamer Salaier was at Hunters Point; steam schooner Hartwood had her keel renewed, a new tailshaft and propeller installed, and Union oil tanker Los Angeles went on Bethlehem ways for general repairs.

Largest Diesel Yacht, New York.—The Diesel cruising yacht Dolphin, built by Newport News Shipbuilding & Dry Dock Company from designs of Cox & Stevens, New York naval architects, for Mortimer L. Schiff, was delivered to her owner on Saturday, June 3. Three months under construction. Claimed to be largest Diesel motor yacht built in this country, 180 feet long, 24 feet beam, 14 feet depth of hold, and equipped with two 500 horsepower Winton Diesel engines. Average speed 14½ knots.

Steamer Overhauled, Hoboken, N. J.—W. & A. Fletcher Company, Hoboken, N. J., was awarded contract for reconditioning steamship Philadelphia, formerly of the American Line and recently sold to New York and Naples Steamship Line. Reconditioning contract, including hull, engine and boiler work, involved expenditure close to $100,000. Transfer of vessel to new ownership and preparation for active service were under supervision of George G. Sharp, naval architect, engineer and marine surveyor, 30 Church street, New York City.

Japanese Fuel Ship Launched, Camden, N. J.—The Kamoi, launched on June 8 at yards of New York Shipbuilding Corporation, Camden, New Jersey, is a fuel supply ship ordered by the Imperial Japanese Navy. On length of about 500 feet and designed draft of 28 feet the vessel has a displacement of 20,000 tons and deadweight carrying capacity of about 13,000 tons. She is electrically propelled, designed to carry 10,000 tons of cargo oil and is expected to achieve 15 knots with 8,000 shaft horsepower. Boilers, special design and coal firing, provision made for oil burning.

SHIPYARDS AND DRY DOCKS

Steel Dry Dock Loose, New Orleans, La.—Steel drydock of Jahncke Shipyard Company broke loose from fastenings at Jahncke wharf and carried downstream with it the steamship Nyanza. Ten tugboats were still at work following morning opposite Port Chalmette. It was found the dock had become submerged, its base being fully thirty feet under water. It required combined efforts of crews of ten tugboats to pump the water out of various compartments of the dock before they towed it upstream.

PORT IMPROVEMENTS

Harbor Improvements, Canada.—Montreal is to receive a loan from the Canadian Government of $5,000,000 for construction of new terminal. Quebec is to spend $1,500,000, to be loaned by the city's harbor commissioners.

Grain Elevator, Owen Sound, Ont., Canada.—G. H. Thompson is interested in a syndicate which plans to build reinforced-concrete and steel grain elevator, 1,000,000 bushel capacity, on waterfront, $400,000. J. H. Tromanhauser, 69 Adelaide street, E., Toronto, engineer.

Additional Docks, Orange, Tex.—The Orange Wharf and Dock Commission employed architects to prepare plans and specifications for additional facilities to be constructed to the municipal docks under the $250,000 bond issue which was sold. Plans and specifications available shortly.

Contract Awarded.—McCaw, Tomlinson & MacDonald, Winnipeg, Manitoba, were awarded contract for dredging the intake and ship channel in the Niagara River, near Chippawa, by the Hydro Electric Power Commission of Ontario, 190 University avenue, Toronto, at price of $500,000.

Channel Improvements, New Jersey.—House passed bill authorizing appropriation of $2,150,000 for improving channel in Newark Bay and the Hackensack and Passaic rivers, and $10,400,000 for establishing a channel thirty feet deep and 400 feet wide through Raritan Bay, Arthur Kill and Kill von Kull, between New Jersey and Staten Island.

Harbor Improvements, Corpus Christi, Texas.—The Senate Commerce Committee have unanimously agreed to incorporate in the rivers and harbors bill a provision committing the Government to an ultimate expenditure of $1,394,000 for the construction of a deepwater harbor at Corpus Christi, Texas. The entire project calls for an expenditure of $5,000,000.

Sheds and Wharves to be Raised, New Orleans, La.—Millions will be expended in raising wharves and sheds at New Orleans to meet standard grade prescribed by United States War Department and Mississippi River Commission and concurred in by Louisiana State Board of Engineers. Work started on six sheds and wharves cost approximately $1,-000,000. After those are completed other sheds and wharves will be raised to standard grade.

New Bunkering Port, Houston, Tex.—Provisions for bunkering Shipping Board vessels at Houston were included in fuel oil contract recently entered into by Shipping Board and the Mexican Petroleum Company. The new acquisition is considered by operators as a marked advantage to the port, as it will enable Shipping Board vessels coming into Houston to lift cargo and take on bunkers at the same time. The bunkering will be handled for the Mexican Petroleum Company by the Houston Oil Terminal Company. The contract is effective until December 31 of the present year.

Dock to be Rebuilt, Norfolk, Va.—The entire south pier of the Merchants Transportation Company at foot of West Main street, Norfolk, Va., is being rebuilt. The work will be in progress during entire summer. The new pier is to be about 600 feet long and of frame construction with galvanized iron covering. New piles will be driven wherever necessary. Work is to be done by construction department of the company. This department is maintained for work on the many terminals at all ports served by the company. During reconstruction the north pier will be used for freight and passenger traffic. The exact cost of the work has not been determined.

GOVERNMENT WORK

Extension to Pier, Pensacola, Fla.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans extension to landing pier at Pensacola, Fla. Specification 4645.

Water Front Development, Pensacola, Fla.—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans water front development at Pensacola, Fla. Specification 4644.

Contract Awarded, Providence, R. I.—J. S. Packard Dredging Company, 1004 Turks Head Building, Providence, R. I., was awarded the contract for dredging in harbor at Block Island, at price of $4,318, by the United States Engineer.

Dredging, Philadelphia, Pa.—The American Dredging Company, 410 Marine and Merchant Building, Philadelphia, Pa., has been awarded the contract for dredging on Liston Range, in Delaware River, 1,476,600 cubic yards excavation, at $0.18 per cubic yard scow measurement, by United States Engineer, 815 Witherspoon Building, Philadelphia, Pa.

NEW INCORPORATIONS

Castle-Lodge Steamship, New York, capital $125,-000, incorporated at Delaware.

Lodge Navigation Company, New York, capital $500,000, incorporated at Delaware.

Mandalay Steamship Corporation, capital $500,000, chartered under laws of Delaware.

The Fall River Steamship Company, capital $40,-000, chartered at Dover, Delaware.

China-America Line, filed application in Albany for increased capital from $150,000 to $1,000,000.

Phoenix Stevedoring & Trucking Corporation capital $100,000, incorporated at Dover, Delaware.

Phoenix Steamship Corporation, increased capitalization from $150,000 to $699,000, under the laws of Delaware.

Foreign Exploration Syndicate, of Manhattan, capital $100,000; incorporators, W. L. Crist, C. P. Stewart and E. Harding.

Ames Terminal Company, Washington, Delaware, capital $150,000, incorporated at Delaware to construct and operate terminals.

Franklin Lighterage Company, Manhattan, capital $5,000, incorporated at Albany; incorporators, J. van Pelt, J. McDonald and L. Kircher.

The Federal Stevedoring Company, capital $5,000 chartered at Albany; incorporators, S. & F. Barbarine and R. A. Flinn, of Manhattan.

The Navigation Steamship Company, Manhattan chartered at Albany for $250,000; incorporators, I. Olsen, M. E. Graef and L. W. Larslen, L. R. Bachner, attorney, 27 Cedar street.

The Northwestern Development Corporation, capital $1,500,000, to operate a steamship and transportation line between Portland and Seward, Alaska, headquarters to be at Vancouver, Washington; incorporators, A. J. Kaiser, L. C. Stringer and H. H. Dickson.

The New York-Naples Steamship Company, capital $250,000, organized under laws of Delaware; President, Mortimer B. Foster; George Ferguson, vice-president, and L. E. Schwartz, secretary and treasurer. Will handle operation of American Line ship purchased recently by United Italian Line.

Todd Shipbuilding and Dry Dock Company, Mobile, Alabama, capital $750,000, incorporated at Mobile; incorporators, William H. Todd, Arthur E. Goddard, John D. Riley, Dennis H. Lanman, of Brooklyn, New York, and Angus Marshall, Joseph H. Lyons and Harry T. Hartwell, of Mobile, Alabama.

Los Angeles General Steamship Agents, Los Angeles, Calif., incorporated recently and has taken over the agency of various steamship lines, including Struthers and Barry, Pacific-Argentine-Brazil, Swayne & Hoyt, Inc., Mexican States, Pacific-Caribbean-Gulf, Furness-Prince and Pacific Australian; incorporators, J. McMillan, C. G. Krueger and Walter Wheaton.

FOREIGN ACTIVITIES

New Motorship Ordered, Liverpool, England.—It is understood the Ocean Steamship Company, Liverpool, has ordered a 10,000-ton deadweight motor ship, about 400 feet long and to be delivered before end of 1922. She is to be equipped with a 3,000 indicated horsepower Burmeister and Wain long-stroke slow-speed Diesel engine, this being by far the largest motor of such a type yet built.

Engine Works Purchased, Glasgow, Scotland.—The shipbuilding firm of Swan, Hunter & Wigman, Richardson, Ltd., Wallsend-on-Tyne, has purchased the North British Diesel Engine Works at Glasgow, the best equipped plant in Britain for building large Diesel units. With the plant of their associated company, Barclay, Curle & Co., and their own plant at Walker, the firm now occupies a leading position as builders of oil engines.

Steamer Launched, Belfast, Ireland.—The passenger and mail steamer Diogenes of the Aberdeen Line has been launched from the new yard of Messrs. Harland & Wolff, Ltd. The launching of this ship was the first official ceremony at the new yard. The Diogenes is a sister ship of the Sophocles and is 500 feet long, 63 feet wide and 35 feet 3 inches deep, with a gross tonnage of 12,300 tons. She is for the owners' Australia trade.

Italian Fabricated Ships.—Six fabricated steel steamers are being built at yards of Cantiere Navale Triestino for Italian Cosalich Line. The fabricated steel was purchased in the United States from the Emergency Fleet Corporation. The first of the series, the Lucia has reached New York on her maiden voyage and is a ship of 8,610 deadweight tons, equipped to burn oil and driven by triple expansion engines of 2,300 horsepower, which give her a speed of 12 knots.

Engines for Steamships, Hamilton, Ohio.—Hooven, Owens, Rentschler Company, Hamilton, Ohio, closed contract with Federal Shipbuilding Company, Kearny, New Jersey, for furnishing two four-cylinder, triple expansion, 2,700 horsepower engines to be installed in new combination passenger and freight steamers which the shipbuilding company is building for Merchants' and Miners' Transportation Company, Baltimore, Maryland.

Four Ships, Great Lakes.—Recent contracts placed on the Great Lakes for new ships include two steel ore freighters to be built by American Shipbuilding Company of Cleveland for Pittsburgh Steamship Company; one steam freighter to be built by the Toledo Shipbuilding Company for the Kinsman Transit Company and one steel bulk freighter for the Franklin Steamship Company, of Cleveland, to be built by the American Shipbuilding Company. Vessels will be 600 feet long for cargo carrying, and propulsion will be by reciprocating engines.

Turpel Shipyard, Victoria, B. C.—It is reported that S. and E. Turpel, formerly connected with the Turpel Shipbuilding Yard and Marine Railway, at Victoria, B. C., are re-establishing the yard and marine railway on the old site, in the upper harbor. The original plant, absorbed by the Foundation Company during the war for building wooden steamships for British government under orders from the Imperial Munitions Board, had been in existence for about 35 years. The marine railway is said to be in course of construction and it is intended to operate a general ship repairing plant and to build small ships.

Trial Trip of Steamer, Belfast, Ireland.—The twin screw steamer Diomed, 10,180 tons, built by Messrs. Workman, Clark & Co., Ltd., Belfast, passed successful trials. The ship was constructed to order of Messrs. Alfred Holt & Company, Liverpool. Her dimensions are 489 feet by 62 feet by 30 feet. There are seven large cargo holds, the cargo gear being of the latest type, and the large number of winches and derricks are specially arranged for the expeditious handling of cargoes. The machinery was built by Messrs. Workman, Clark & Company, and consists of two sets of Brown-Curtis double reduction geared turbines, giving speed of 14½ knots.

Steamer Construction, Port Arthur, Ont.—The Port Arthur Shipbuilding Company, Port Arthur, Ont., has laid the keel of the steamship Mathewston. She will be a steel bulk freight steamship for Great Lakes service, for the Mathews Steamship Company, Toronto. The vessel will be 550 feet long, 58 feet wide and 31 feet deep, with a capacity for over 400,000 bushels of grain. Propelling machinery will consist of triple expansion engines, cylinders 25½, 41 and 67 inches diameter, by 42-inch stroke, supplied with steam by three Scotch boilers, each 13½ feet diameter by 11 feet 2 inches long, at 185 pounds working pressure, equipped with interchangeable furnaces. She is being built to the highest class for the Great Lakes, of the American Bureau of Shipping.

Motor Passenger Liner, England.—The Adda, large motor passenger liner under construction for the African service of Elder Dempster & Co., Ltd., was launched on May 25 from Harland and Wolff's Greenock yard. The ship's dimensions are as follows: length, 450 feet; breadth, 57 feet; molded depth to awning deck, 34 feet 6 inches. Her gross tonnage is about 7,800. There will be three complete decks. Passenger accommodations will be very spacious and luxuriously furnished. Berths are to be provided for 225 first, 74 second, and 32 third-class passengers. Propelling machinery will consist of two Burmeister and Wain type engines built by Harland & Wolff at Glasgow. They will each develop 3,000 indicated horsepower at 115 revolutions per minute.

Three New Motorship Contracts, Denmark.—An order has been placed by the Svendborg Shipping Company for a single-screw motorship, which will be one of the largest of its type equipped with Burmeister and Wain machinery. It is to be constructed at the Odense Shipyard, Denmark, and will have deadweight capacity of 5,100 tons. The new vessel will have the following dimensions: length between perpendiculars, 331 feet 3¾ inches; breadth, molded, 44 feet; depth from the shelter deck, 28 feet 11 inches. She will be of the open shelter-deck type and will have a speed of 10½ knots when fully laden. The same company has also ordered from the Odense yard two 7,770-ton deadweight, twin-screw motorships with a length of 378 feet 2 inches each, and the machinery will be constructed by Burmeister and Wain, Copenhagen.

Diesel Motorship, Copenhagen.—May 6, a new Diesel motorship was launched at the Copenhagen yard of Burmeister & Wain and was named Thalatta. She is being built for the Norwegian African & Australian Line, Tensberg, Norway. The ship is a sister vessel to the M. S. Teneriffa, which was recently delivered to the Mexican Gulf Line. The Thalatta is built to highest class of British Lloyds and intended for ordinary cargo-carrying trade, the main dimensions being 425 feet 5½ inches by 55 feet by 38 feet 6 inches, and her deadweight capacity being about 11,000 tons. The ship is being fitted with two Burmeister & Wain Diesel engines, developing in total 3,100 indicated horsepower and capable of giving the loaded ship a speed of 11¼ knots. The fuel oil consumption for 24 hours is about 10 tons. Cooling plants for the stores and a few but especially well equipped passenger rooms are arranged.

STEAMSHIP INTERESTS

The Admiral Line has made a slash of 50 percent in charges for carrying automobiles, as a move to stimulate tourist traffic between points on California, Oregon, Washington and British Columbia coasts. The line is now operating five passenger and freight steamers between Puget Sound and Californian points and two between Portland and California. Under the new rates, automobiles are handled under the baggage service.

The New York & Porto Rico Steamship Line has reduced its passenger fares between New York and ports of Porto Rico. The company's sixteen-day cruise around the island, which for years has been a popular vacation feature, is reduced from $180 to $150 for minimum accommodations and the one-way fare from New York to San Juan is now $65 instead of $75. These reductions are permanent.

The Luckenbach Steamship Company inaugurated from San Francisco, with the sailing of the freighter *Pleiades,* a monthly service in the Pacific Coast-Gulf service. The company is now operating four vessels in the service.

Owing to a prospect of good business in the fall, the Furness-Prince Line proposes to resume its Pacific coast European service in August or September. The Furness-Prince Line boats have been going to the Far East for several months.

The Atlantic Fruit Company has cut its passenger rate from New York to Porto Rico. The fares have been reduced approximately 20 percent with the former minimum of $75 reduced to $60. The Atlantic Fruit Company operates a weekly service to San Juan, Ponce, Mayagues, Arecibo and Aguadilla.

TRADE PUBLICATIONS

MICARTA GEARS AND PINIONS.—To fill the demand for a silent gear drive the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., has developed a non-metallic gear material known as Micarta which is described in a recent catalogue issued by this company. General technical data on the cutting of gears from this material are contained in the bulletin, as well as tables of pitch, tooth thickness, horsepower ratings, etc.

MERCHANT SHIP AUXILIARIES.—A bulletin containing engineering data pertaining to marine motors and controllers for engine room auxiliaries and deck machinery has been issued by the General Electric Company, Schenectady, N. Y. Concise information is given on horsepower, voltage, speed, weight and approximate dimensions of standard type marine motors; and special attention devoted to the question of lubrication, moisture proof windings, non corrodible fittings, water tightness, etc. The cost of equipment is not given in the bulletin because of the fluctuating condition of the market, but will be supplied from the company's offices.

VELOCITY STAGE TURBINES.—A line of velocity stage turbines, especially designed for high pressure and high temperature steam is described in a catalogue issued by the DeLaval Steam Turbine Company, Trenton, N. J. The turbines are built in sizes up to 1,200 horsepower and are designed to be directly coupled to high speed centrifugal pumps and blowers, small alternating and direct current generators, and by means of double helical speed reducing gears to large pumps and blowers, medium size generators, belt pulleys, rope sheaves and slow and moderate speed machinery.

BUSINESS NOTES

Mr. Adolph Starr, who for four years was associated with The Superheater Company in their marine sales and service division, has severed his connection with that company and has taken up the duties of Assistant Sales Manager for the Seminole Chemical Company, dealers in boiler cleaner, at 75 Vesey street, New York City. Mr. Starr, who has spent a great many years in various branches of the marine industry, is receiving the well wishes of a large number of friends in the marine field.

Mr. L. D. Howell, formerly of the marine department of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., is now attached to the marine division at the New York office of the same company in association with Mr. Norris R. Sibley.

The American Bridge Company announces the location of the Vice President's Department, Chief Engineer's Department, Eastern Division Contracting Department and Treasury Department, in the Empire building, 71 Broadway, New York, N. Y. (telephone, Whitehall 3290), which became effective on June 24.

The American Abrasive Metals Company of 50 Church street, New York City, the manufacturers of feralun, alumalun, vulcalun and bronzalun anti slip treads announce their appointment by the Carborundum Company of Niagara Falls to act as United States sales representatives through whom will be marketed the carborundum anti slip tile.

The Titan Iron and Steel Company, Inc., Newark, N. J., manufacturing mechanically puddled wrought iron, has announced the appointment of W. Woodward Williams as vice-president.

The Lake Torpedo Boat Company, of Bridgeport, Conn., announced that at a meeting of the Board of Directors on May 12, Henry J. Miller was unanimously elected president of the company to fill the vacancy caused by the death of his brother, Herbert S. Miller.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—S. M. Robinson.
U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City.
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

Marine Engineering
and Shipping Age

AUG 7 - 1922
U. S. PATENT OFFICE

Volume XXVII | August, 1922 | Number 8

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
L. S. BLODGETT, Associate Editor — W. Z. GARDNER, News Editor

Contributing Editors

Rear Admiral C. W. Dyson, U. S. N.
Captain C. A. McAllister, U.S.C.G. (Retired)
Commander S. M. Robinson, U. S. N.
Winthrop L. Marvin
William Gatewood
H. McL. Harding
William T. Donnelly
James L. Bates

WE GUARANTEE that of this issue, 5,800 copies were printed; that of these copies 4,198 were mailed to regular paid subscribers, 129 were provided for counter and news company sales, 231 were mailed to advertisers, 29 were mailed to employees and correspondents and 1,213 were provideed for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 44,250—an average of 5,531 copies a month.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

In the Laps of the Gods

AT this writing the fate of the shipping bill and, incidentally, our merchant marine, lies in the balance. Senator Joseph E. Ransdell, democrat of Louisiana, has just delivered a stirring speech in the Senate in which he showed the bitterness of organized foreign opposition to the pending bill. Many would have us believe that the opposition to the proposed subsidy comes from the Middle West but, if this is true, how does it happen that the Mississippi Valley Association, embracing a membership in 28 states, should address Senator Ransdell, declaring that "proof is now conclusive that the powerful shipping interests of England are determined, if possible, to prevent the enactment of the ship subsidy bill?"

The Mississippi Valley Association, at least, is tired of having the responsibility for the apathy or lack of action by Congress placed upon the Middle West. President Harding evidently entertains the same point of view, for he has made it plain that the bill should pass during this session and that the whole country is behind it. In other words, the "defeatist" propaganda whether started by foreign interests or, as is more likely the case, by Americans employed by foreign interests, should delude no one into the belief that America is not determined to pass this bill the provisions of which are so vital to our merchant marine.

Following Senator Ransdell's speech, President Harding let it be known that he is still determined that the ship subsidy bill shall be passed during the present session of Congress. It must be remembered that he only agreed to a postponement of action on the measure on condition that it would be taken up again before the summer was over. It is therefore our prediction that he will demand that the House shall take this matter up immediately after reconvening on August 15.

The same feeling of uncertainty existed in regard to the reconditioning of the *Leviathan* for a couple of months before the contract was signed. Chairman Lasker of the Shipping Board, however, constantly declared that this great ship would be refitted for service and, just as he was right in his judgment then, so he is now in regard to the shipping bill. He has full confidence that the bill will be passed at this session and he is not allowing himself to be worried over reports that the Senate leaders are trying to eliminate the subsidy legislation from their program.

Chairman Lasker knows that the shipping bill was prepared from the facts and findings of the most competent committees of marine experts ever gotten together in this country. He has had the most exhaustive studies made on the subject as the twenty-five hundred and odd pages of the recent testimony taken before the joint hearings of the Committee of Commerce and the Committee on the Merchant Marine and Fisheries will show. He knows that he is right in advocating ships built and manned by Americans for commercial purposes and for safety in time of war. But of still more importance he knows that the opposition has no arguments that will hold water and that its only hope of defeating the shipping bill is to delay action. This it cannot do unless the country has reached the zenith of its destiny and has started downward.

Economical Fuel Consumption

ONE of the greatest single steps taken by the Shipping Board to secure maximum economy in ship operation has just been started by Mr. Joseph E. Sheedy, acting vice-president of the Emergency Fleet Corporation. Mr. Sheedy has organized a committee under the chairmanship of Captain C. A. McAllister to study the proper basic fuel consumption of Shipping Board vessels, to review present fireroom practices and burning equipment and to recommend improvements in each.

Under present conditions it is absolutely imperative to reduce the cost of ship operation to a minimum and no single item of the operating costs amounts to as much as the fuel bill. MARINE ENGINEERING AND SHIPPING AGE has re-

peatedly hammered this point for a great many years particularly in the articles written by "Old Scotch." We therefore feel that we have had some influence in creating this committee whose work will undoubtedly be of great value to private shipowners as well as to the Shipping Board.

Senator Marconi Receives Highest Engineering Honor

THE John Fritz medal, America's highest engineering honor, was awarded to Senator Guglielmo Marconi in the auditorium of the Engineering Societies Building on Thursday, July 6. This medal, which is of gold, is awarded not oftener than once a year. It is accompanied by a certificate stating the origin of the medal, the specific achievement for which it is awarded and bearing the signatures of the sixteen members of the board making the award. The board is composed of four representatives from each of the four National Societies of Civil, Mechanical, Mining and Electrical Engineers.

It should be particularly gratifying to the marine profession that the award this year has been made to Senator Marconi. His invention, which was almost immediately applied to ships, has taken from the sea many of its perils and even when disaster has occurred it has been the means of saving large numbers of human lives. In the case of the *Titanic* disaster alone, it is not probable that a single soul would have been rescued, if it had not been for the wireless telegraph.

Radio has made it possible for ships at sea to give their location and condition to the shore and to other vessels; it has made it possible, through triangulation, for shore stations to inform a ship of its exact position and its proximity to dangerous shoals when fog or bad weather conditions prevent the taking of observations; it has made it possible to warn ships of approaching storms, and for them to keep in continuous communication with the entire world. Certainly no one has done more or has been of more benefit to those who live and travel the seas than Senator Marconi.

Cadet Engineers

THE White Star Line is finding it profitable to give engineering students from the Liverpool University a position on their liners during the summer vacation. This scheme, which was inaugurated by Mr. Willet Bruce, the company's superintending engineer, was started last summer and provides a position for an engineering student on each liner leaving Liverpool between July 1 and October 5.

The students either take watches with the regular engineers or are given duties connected with the running of the auxiliaries and the overhaul of deck machinery. The practical experience that they get in this way could not possibly be obtained on shore and those students who seize the opportunity ought upon graduation to have a far better chance of securing a desirable position with a steamship company.

On the other hand the steamship line that gives such an opportunity to engineering students not only secures enthusiastic workers for practically nothing but it also has the chance of picking the most efficient men for future employees. All American lines whose engineering staffs ashore and afloat are not 100 percent efficient might give some thought to such a scheme. Henry Ford has the same idea only in his characteristic big way he has established a school for 600 boys who are given practical training in his shop. The results of these instances of combined theoretical and practical training are for the future to disclose but, if Henry Ford and the White Star Line think it advisable to train their future personnel, other companies might do worse than follow their example.

Simplification and Standardization

DUE to the fact that ships are usually built one or two at a time and then to meet the particular requirements of a specific trade and route, an opportunity to take advantage of the savings that can be accomplished by quantity production of standardized vessels such as were built during the war will never be repeated.

However, there is an opportunity to do much in the way of standardization and simplification in the fittings and equipment that go into a ship. The Navy Department and several shipyards have developed a number of standards for which, in a great many cases, expensive dies, patterns and jigs have been made. The standards of one yard vary to a greater or lesser degree with the standards of another yard and, on account of the above-mentioned expensive dies and patterns, to say nothing of the personal opinions of the chief engineers of the various shipyards, it will be a difficult matter to interest the shipbuilding fraternity in harmonizing these standards and making them universal.

England, however, which is considered more conservative than this country and whose shipyards are much older than ours, is doing this very thing. The British Engineering Standards' Association has appointed committees consisting of men of the highest authority in their respective lines who have met at frequent intervals and examined drawings and sketches of proposed standards.

Not only have they done this, but they have also adopted a large number of standards during the past few years which have eliminated the manufacture of an unnecessarily great number of articles serving one purpose. This has been of substantial benefit to the shipbuilding industry in that country as a whole as it has prevented overlapping, and it is in line with the principle of industrial standardization that has been practiced successfully in other industries.

Mr. Herbert C. Hoover states in an article that appears on page 481 of this issue that the avoidance of waste in the industries is more important than great inventions. He has established in the Department of Commerce a Division of Simplified Practice which stands ready to cooperate and assist the industries to bring together representatives from all interested bodies in any industry for the purpose of effecting standardization and simplification. Is it not a worthy subject for the Society of Naval Architects and Marine Engineers, the American Engineering Standards Committee, the American Bureau of Shipping, the shipowners and shipbuilders to take up with the Department of Commerce in order that the cost of construction of ships between this and foreign countries may be decreased rather than increased?

Plans for American Marine Week Far-Reaching

To Be Great Convention of All Associations Interested in Developing a Real American Merchant Marine

THE big shipping event of the year, American Marine Week, November 4-11, with its Marine Exposition at the Grand Central Palace, New York City, with its convention of the Society of Naval Architects and Marine Engineers, with the meetings of the technical committees of the American Steamship Owners' Association and the American Bureau of Shipping, and with its banquets and smokers, will be the greatest get-together of the various interests in the marine field that this country has ever seen.

It is the primary purpose of American Marine Week to attract the attention of the whole country to our merchant marine. Shipping legislation is now pending before Congress which is of vital importance, not only to shipping, but also to the prosperity of every other industry. Therefore, this is a time when the cooperative efforts of all marine associations can be used to the best advantage.

American Steamship Owners' Association

Mr. Winthrop L. Marvin, vice president and general manager of the American Steamship Owners' Association, in speaking of the forthcoming event, said, "I believe that this movement is in every way deserving of the heartiest encouragement and I expect that the American Steamship Owners' Association will participate to an even greater extent than they did last year."

At the conclusion of the last American Marine Week, Mr. Marvin made the following statement in a letter to the editor of Marine Engineering and Shipping Age: "It is unquestionably the wisest and best plan to hold the annual marine exposition at the same time with the annual convention of the Society of Naval Architects and Marine Engineers. The exposition this year has been remarkably satisfactory from the standpoint of the shipping trade. Exhibits were well considered and skilfully arranged and they strongly appealed to the serious attention of the practical men of our maritime industries. We heartily felicitate the management of the exposition on the valuable results attained."

Society of Naval Architects and Marine Engineers

The annual convention of the Society of Naval Architects and Marine Engineers always has been an important occasion to the leading technical men in the marine profession. It is at these conventions that papers covering the developments in shipbuilding and marine engineering are read and discussed and there is no doubt that these meetings have been of tremendous benefit to the industry as a whole. In commenting on the desirability of holding the annual marine exposition at the same time, Mr. E. H. Rigg, naval architect, New York Shipbuilding Corporation, said last year: "The exposition unquestionably gave an opportunity to those directly interested in maritime affairs, as well as to the general public, whose interest in maritime affairs is undoubtedly much greater than before the war, to see a very full line of maritime equipment and fittings assembled under one roof and in such a way as to be both useful and interesting." There were many in New York for the purpose of attending one or the other of the concurrent meetings, so that advantages should have accrued to each participating organization.

In like manner, Mr. Hugo P. Frear, naval architect of the Bethlehem Shipbuilding Corporation, Limited, in speaking of the last American Marine Week gave his opinion that "the idea of holding the show in conjunction with the meetings of the Society of Naval Architects and Marine Engineers appeals to me and I think this arrangement should be continued so long as there appears to be an advantage in the combination."

American Bureau of Shipping

The American Bureau of Shipping will take part in the forthcoming American Marine Week by holding meetings of their board of managers and their technical committees. The bureau is the only American organization of its kind in this country and it is the official classification society for United States Government-owned ships. It can always be depended upon to support any movement that will aid in the development of an American merchant marine.

Maritime Association

The Maritime Association of the Port of New York, whose fiftieth anniversary will occur next winter, has been invited to participate. Mr. Charles H. Potter, president of that association, when interviewed by a representative of Marine Engineering and Shipping Age, declared himself as heartily in favor of the movement. He said that he would recommend participation by his organization at their next meeting.

The Sea-Going Engineers

The Ocean Association of Engineers will hold a big smoker during American Marine Week and they will see that every engineer on every ship in the Port of New York at the time is furnished with tickets admitting them to the marine exposition. Mr. Bert L. Todd, secretary of the association, declared "that he believed that American Marine Week will be a means of interesting the people in an American merchant marine and that it was deserving of support from all organizations connected with shipping."

The Masters and Mates

Capt. John F. Milliken, secretary-treasurer of the Neptune Association, which is composed of the licensed masters and mates of ocean and coastwise steam vessels, and also secretary-treaurer of the Ocean Officers' Conference, which includes the licensed deck and engine room officers and the radio telegraphers, declared that the Neptune Association would hold a big smoker during the week and that probably this smoker would be held in conjunction with the marine engineers. During the week the Ocean Officers' Conference will hold a meeting of its executive committee and officers.

Captain Milliken hopes that there will be an opportunity during American Marine Week for delegates from all marine associations to get together in a special meeting for the purpose of discussing our merchant marine problems and he believes that such a meeting would undoubtedly result in some very valuable suggestions.

National Merchant Marine Association

The National Merchant Marine Association, through its secretary, Henry C. Wiltbank, has notified the American Marine Association that its executive committee is in favor of cooperating in the event and that it will be glad to arrange the details for its participation.

American Marine Association

Steps are now being taken to complete final arrangements of the Second Annual Marine Exposition, to be held under

the auspices of the American Marine Association, Inc., November 4-11, 1922, at the Grand Central Palace, New York City. The various committees of the association are now actively undertaking the duties assigned to them, in order to assure a most successful gathering of the marine interests. Already space reservations for the November exposition presage an interesting and ambitious presentation of the varied phases of shipping activity, embracing shipbuilding and its allied branches, ship operation and the extensive group of supply organizations.

K. W. Heinrich to Direct Marine Association

In order properly to co-ordinate committee activities, the American Marine Association, Inc., has prevailed upon Mr. K. W. Heinrich, who has been identified with the Bethlehem Shipbuilding Corporation, Ltd., to accept the management and direction of the association. In this capacity, Mr. Heinrich will execute the recommendations of the various committees looking after all details in connection with the exposition and association affairs. It is certain that the cooperation of other marine organizations will be secured to such a degree, that the November Marine Exposition is certain to command national attention, both from its business aspects, as well as the influence it will exert in furthering the interests of an American merchant marine. Mr. Heinrich has had broad experience in exposition development as a result of his work with the Bethlehem Shipbuilding Corporation, Ltd., and this experience, in conjunction with his extensive knowledge of maritime affairs, is expected to give to the American Marine Association many benefits of direct contact with the industry and its allied ramifications.

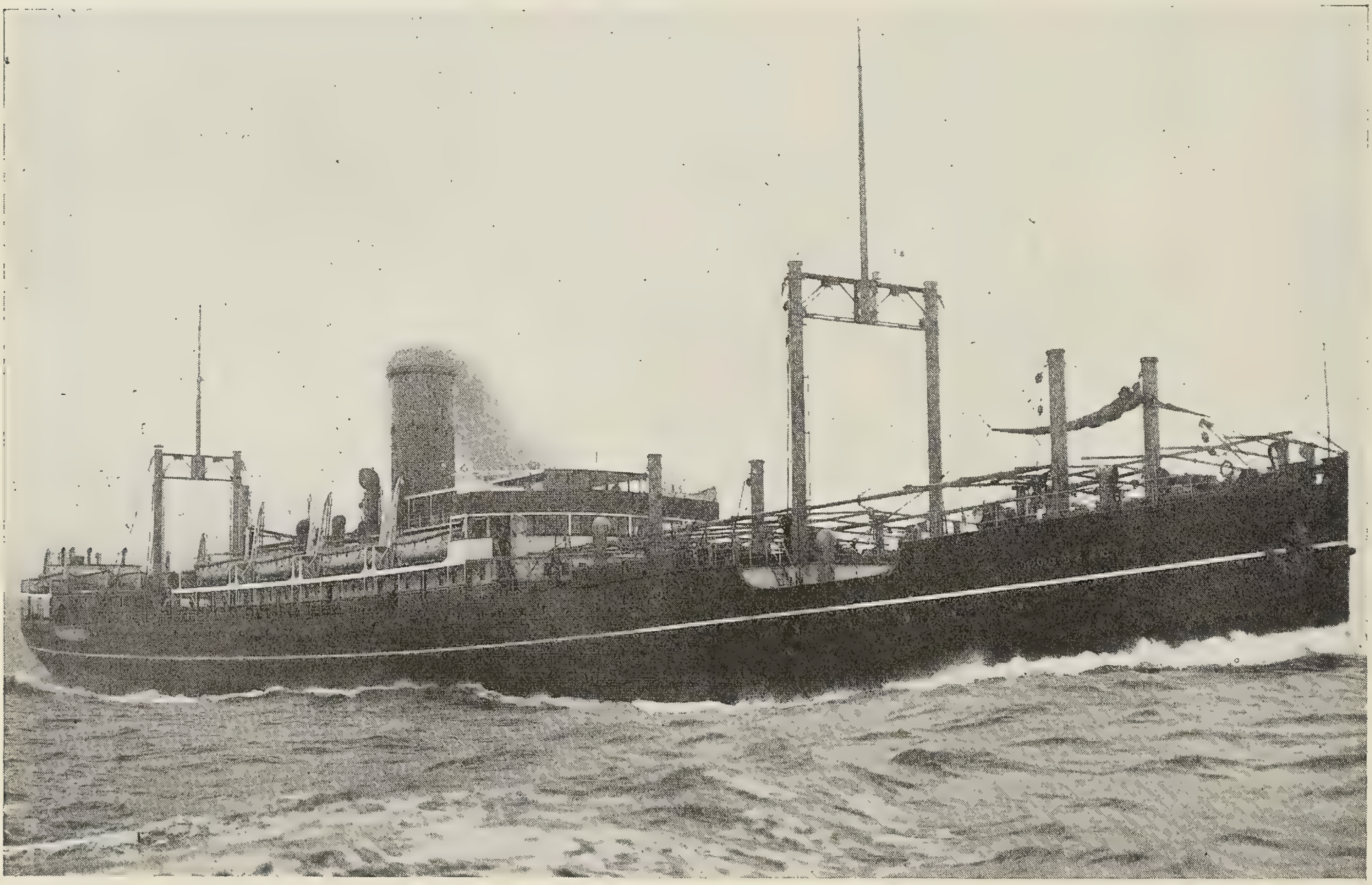
Exhibit Space Reservations

The exhibits committee of the association has about completed its preliminary work and over the next few months it is confidently expected that definite space reservations will be had for the majority of the organizations that participated in the previous exposition, as well as many others who hitherto have not exhibited their products.

The membership committee has been industriously soliciting support from marine concerns, who are not in a position to exhibit, but who are contributing their moral support to the successful consummation of the aims of the association.

Shipbuilders to Be Represented

In an interview with J. L. Ackerson, president of the Atlantic Coast Shipbuilders' Association, a representative of Marine Engineering and Shipping Age has learned that the Atlantic Coast Shipbuilders' Association will be represented at the Marine Exposition by an official committee. Furthermore, this association will help in other ways to make the Exposition and Marine Week an unqualified success in every way. The Atlantic Coast Shipbuilders' Association is the leading organization in the American shipbuilding industry and is the active medium through which shipbuilders seek to secure united action on shipbuilding problems.



Photograph by Frank & Sons, South Shields.

Steamship Kutsang on Her Trial Trip

The Indo-China Steam Navigation Company has just increased its fleet by the addition of the *Kutsang* built at the Wallsend Shipyard of Swan, Hunter & Wigham Richardson, Limited. The ship's name is Chinese and signifies "Increase in Luck." In spite of somewhat boisterous weather, the trials at sea were successfully accomplished and a speed of 13.6 knots on a draft of 23½ feet was averaged over a course of 40 knots along the coast off the mouth of the River Tyne. The *Kutsang* has an overall length of 434 feet, a beam of 54 feet and a depth of 31 feet. She carries 7,800 tons deadweight on a draft of 26 feet 3 inches, and has been built to Lloyds highest class. On the bridge deck are quarters for the officers and engineers together with commodious staterooms and a handsome dining saloon for first class passengers. On the boat deck is accommodation for the captain and for first class passengers, smoking room and ladies' room. Second class passengers are accommodated in the poop, and a hospital and dispensary are placed above the steering gear house.

Ship Subsidy Bill Stands on Its Own Merits

Educational Campaign Shows Basic Facts Underlying the Bill Irrefutable—Forms Keynote of Policy of Present Administration

By "Old Scotch"

"BOOZE" has been a trouble-maker ever since mankind has made use of it for purposes of exhilaration and to chase away gloom. Just as the stage was set for consideration of the subsidy bill, along comes a famous temperance advocate, a (per force of circumstances) reformed brewer, who spills the beans and starts a general alarm throughout the land because of his discovery that booze was being sold on board passenger ships operated by the Shipping Board. Without knowing anything about the motives which impelled this "nouveau" temperance advocate to jump in the breach at this critical time, it looks to a bystander very much as if there existed in his bosom a sentiment such as "If we can't make it on shore, we'll see that no one sells it on the ocean."

Sale of Liquor on American Ships Never a Secret

Everyone at all cognizant of maritime affairs knew full well that American ships, by competent legal authority, were "wet" beyond the three-mile limit. Nothing was done officially to suppress this fact from the public and anyone having the slightest interest in the matter would have been advised that such was the case. A former United States senator, who was one of the wheelhorses of the prohibition movement, made the announcement in the open Senate in January last, that he had recently returned from London on a Shipping Board vessel and that he saw liquor being sold on that ship. No one expressed any surprise, nor did the press make any more than passing comment on his statement. Yet when this ex-brewer made the same kind of a statement last month, the opponents of the subsidy bill seized the opportunity to raise a hullabaloo which was heard all over the world.

The net result of this re-vivified exposé has been the postponement of the consideration of the bill until August 15, when the House of Representatives reconvenes. This, after all is said and done, is probably a blessing in disguise. It will give Congressmen, who themselves were none too familiar with the subject, a chance to study the subject and take counsel with their constituents as to how they should vote when the bill comes before them. Hence the period from July 1 to August 15 will undoubtedly be occupied to a considerable extent by discussions on the value of a merchant marine to the country at large.

Shipping Legislation the Keynote of Present Administration

The administration officials in Washington are so firmly convinced of the righteousness of the cause that the merchant marine legislation has been made the keynote of the announced policy of the present Government. Whatever the great voting public may think of the actions of the present Congress, or rather the lack of action, there is on all sides a firm conviction that the executive branch of the Government has accomplished much for the benefit of the country, despite legislative shortcomings. Hence it should be realized by congressional candidates for re-election that they themselves are on trial before the bar of public approval, and not the officials of the executive branch of the Government.

The public has strong faith in President Harding's policies and motives, and they undoubtedly give him credit for knowing the conditions which have impelled him to stake the reputation of his entire administration on the success or failure of the pending merchant marine legislation. They know that he is a man from an interior state, a representative of that great middle west which we all speak of with so much veneration as reflecting the last thoughts and actions of the entire country. They know that neither he nor his immediate surroundings have financial interest in the rise or fall of our shipping. He and his co-laborers in this cause have approached the entire shipping subject on the broadest of patriotic grounds, and with a vision that calls for the unstinted approval of all thinking Americans who can look beyond the immediate present and realize how helpless this nation will be in the years to come, if we do not seize this present opportunity and firmly establish an efficient merchant marine to stabilize our commerce in times of peace and to serve as the backbone of our national defense, if war again comes. This very faith of the public in our present executive is in itself a tower of strength and Congressmen, who are wavering in their decision as to whether or not they will support the subsidy bill, should give very careful thought to this factor.

No Sound Reason Yet Advanced for Opposing Subsidy Bill

If facts instead of misinformation are given to the public, there is little reason to have any apprehension as to how they will expect their Congressman to vote on the pending bill. The opponents of the measure have not as yet brought out a single good reason why the bill should not pass. The minority report contains nothing of real value by means of just criticism. The contentions advanced are captious and have little or no bearing on the great underlying principles involved. For example, several pages of the minority report are devoted to the enormous profits made by certain American steamship lines during and just after the war.

What has that got to do with the question? Anybody could make money during times such as we have passed through. No doubt the proprietors of many peanut stands may have made profits of 600 to 1,000 percent during those inflated days. The only difference is that the Government took away most of the shipowners' profits by means of war and excess profit taxes, whereas the itinerant peanut vendor, and like gentry, placed their ill-gotten gains in the family stocking and probably are now living in comparative luxury in their native countries.

Several tables of comparative wages on American and foreign ships are published for the years 1916, 1917, 1918 and 1919, all of which, like "the flowers that bloom in the Spring, have nothing to do with the case" as it exists today, and will not in the future. There is no question in the minds of men who know, that wages paid to officers and men on American ships are now and always will be higher than those paid for like services on foreign ships. The American farmer and the American mechanic are better paid, and should be, than similar vocations in foreign countries. Is it right or fair to expect that Americans who go to sea in American ships should have their standards of living lowered because of that fact? There is now and always will be a higher cost of ship production in this country as compared to similar activities abroad, for precisely the same reasons that exist for the better paid farmer and mechanics. These

basic facts must not and cannot be lost sight of in the consideration of our merchant marine.

Subsidy Bill Means Economy—Not Extravagance

An attempt is now being made in high congressional sources to place the subsidy bill in the list of great Government extravagances. Nothing could be further from the truth. And it is difficult to understand how anyone with sufficient mentality to be elected to Congress can arrive at such a conclusion, after he has given the subject a fair and impartial diagnosis. No doubt many of these legislators are sincere in their convictions and, if they could stop looking at the matter politically and treat solely from the standpoint of statesmanship, they would change their conclusions. As to direct costs of the subsidy, plain ordinary arithmetic, and not statesmanship, is all that is necessary to convince any fair-minded person that this bill should be classed as Governmental saving, instead of an extravagance. Let any one interested make his own calculations based on the following indisputable facts:

(a) By direct appropriation we are now making up the losses of Government operation of ships, to the tune of $50,000,000 per year.

(b) The average amount which will be expended, if the subsidy bill is passed as written, will not exceed $35,000,000 annually, for the entire period of ten years.

(c) We have today in Government ownership a fleet of vessels costing over $3,000,000,000, which, under existing conditions, can hardly be given away. For each month of delay the deterioration on this fleet is enormous and in addition large sums of actual cash must be expended for caretakers.

(d) Passage of the subsidy bill will enable private owners to buy and operate these ships in competition with foreign ship operators. This fact will enhance the sales value of this fleet not less than $300,000,000, and possibly $500,000,000, all of which will be paid into the United States Treasury during the next ten years.

Now so far as the Treasury is directly concerned, and incidentally the great American taxpayer, if any fair-minded citizen can figure out how this bill will be "another drain on the Treasury," "a reckless waste of Government funds," etc., etc., as has been declared, I would like to be shown. Verily the plain ordinary rules of arithmetic would have to be re-written and the laws of common sense reversed, if any such conclusions can justly and fairly be arrived at.

Indirect Benefits No Less Important

The indirect benefits which the nation will receive in the fostering of our agriculture and commerce, and the sense of security from attacks of enemies in time of war, are so immeasurable as to defy statistical enumeration. There statesmanship and vision must fill in the columns which arithmetical computations will fail properly to show.

If every American citizen would carefully weigh basic facts in this brief campaign of education we are going through, and not listen to the misrepresentations and quacking which are being spread broadcast throughout our land, there need be no fear as to the ultimate results. What splendid opportunities await our representatives in the House and Senate to make known the basic truths underlying this question of a merchant marine! Let them rise above the carping criticisms of the minor details of the measure now before them and enlighten the public as to the fundamentals underlying the possession of an adequate merchant marine. The President of the United States says it is the most important piece of legislation confronting the country today. Who can say to the contrary, and base his statement on the cold logic of facts?

The Traffic Department, United States Shipping Board Emergency Fleet Corporation, has received advices that the Atlantic Intercoastal Conferences, at a meeting held in New York on June 28, decided that as a result of the withdrawal of the American Hawaiian Steamship Company from the conference the remaining members had no alternative but to throw rates in this trade open.

(Photograph copyrighted by Keystone View Company, Inc., of New York.)

New White Star Liner Pittsburgh, Which Recently Completed Her Maiden Voyage from Liverpool to Boston and Philadelphia

Triple screw passenger and cargo steamer of 16,600 gross tons built and engined by Harland & Wolff, Belfast, Ireland. Length overall, 600 feet; beam, 67 feet 6 inches; molded depth, 45 feet 6 inches; cabin passengers, 600; third class passengers, 1,800. Propulsion is by combination machinery, the wing screws being driven by four-crank, triple expansion reciprocating engines with cylinders 28, 44, 49½ and 49½ inches diameter with a common stroke of 54 inches, and the center screw by a Parsons reaction turbine. Steam is supplied at 215 pounds per square inch working pressure by 6 double ended, oil-fired Scotch boilers arranged for natural draft. Electric generating plant develops over 1,000 horsepower.

Alien Propaganda Against American Ships

Direct or Indirect Efforts to Prevent America from Safeguarding Commerce and Insuring National Defence Are Unfriendly Acts

By Winthrop L. Marvin*

When Senator James E. Watson of Indiana arose in the Senate recently to rebuke the British Ambassador, Sir Auckland Geddes, for speaking too freely to American audiences against President Harding's shipping bill and a protective tariff, Mr. Watson voiced in parliamentary but earnest language a thought that had long been in the minds of many American citizens. A few days thereafter Sir Auckland departed from New York, ostensibly for a vacation in his own tight little isle beyond the herring pond. There may or there may not be any connection between these two episodes, but there can be no mistaking the fact that the American people are sensitive to anything that looks like interference from foreign quarters with the policies bearing upon American business and the American merchant marine.

American shipping men are perfectly well aware that the aspirations of this nation to possess a merchant fleet comparable with that owned and operated by our forebears prior to the Civil War are not exactly regarded with favor in the United Kingdom. Up to a few days ago the British newspapers dealing with maritime and mercantile affairs were singularly incautious in attacking the shipping subsidy bill of our National Administration and were openly hoping and predicting that it would fail. These British editors are apparently oblivious to the fact that some 10,000,000 gross tons of shipping had been built or started in the United States for the primary purpose of saving Great Britain and France and Italy, and incidentally the world, from the onslaughts of the Huns. Most of these ships were built in a hurry, many of them, perhaps, not on the wisest plans. Because of the emergency they could not be called typical products of American shipbuilding. Confessedly they had their faults, and since the armistice these faults have been constantly paraded in the British press in a manner that cannot be said to be consistent with the best ideals of international propriety.

Our Coastwise Policy Criticized

But these things are trivial in comparison with the very frank campaign which the distinguished British Ambassador had plainly been making in the United States, notably in public addresses chosen for deliverance at those great mid-Western maritime centers of Minneapolis and Chicago. At Minneapolis, in a set speech before the Civic and Commerce Association on November 4, 1920, Sir Auckland had dropped an admonition, which he was careful to insist was not at all a threat, that, if the United States government extended its coastwise policy to include the Philippines, there might be some very serious reprisals from Great Britain. Though his language was not at all boisterous, his meaning was clearly evident in what the British diplomatist said. In the course of his address at Minneapolis he spoke at some length on the subject of shipping, saying in particular:

> "Under your laws only American ships may engage in American coastwise traffic. This is a matter for your own decision; we make no comment on your policy. Our present policy is that any ships may engage in British coastwise traffic. I may, however, point out, not in any sense as a threat, however veiled, but as a matter of interest that if a law precisely similar to your coastwise traffic law were adopted by the British Empire, there would be some far-reaching derangements in the business of non-British shipping."

*Vice-president and general manager of the American Steamship Owners' Association, New York.

Language of this kind would never have been uttered by a British Ambassador in hot-tempered, quick-triggered France. Nothing like it as against Teuton aspirations for a merchant marine would ever have been uttered by an envoy of His Britannic Majesty in Germany. Of course it is different in the United States. Our people are historically more tolerant, not to say thick-skinned. And neither Minneapolis nor Chicago can be said to be as profoundly interested in the unfolding of the American merchant flag at sea as Boston or New York or Baltimore or New Orleans. Nevertheless, under the circumstances these words of Sir Auckland Geddes at Minneapolis were words that might better have been left unsaid.

Similar American Interference Hard to Imagine

It is impossible to imagine the American Ambassador at the Court of St. James in a public address at Birmingham or Manchester prior to the writing of the agreement between the British government and the Cunard Line for the enormous subsidy that produced the *Lusitania* and *Mauretania*—it is impossible to imagine the American representative in Great Britain using words similar to those which Sir Auckland Geddes employed to his Middle Western audiences. As a matter of fact, no American Ambassador in Great Britain at that time would have even remotely mentioned the Cunard contract, to say nothing of entering an adroitly veiled protest against its making. When the British Parliament, without a dissenting vote, directed the loaning of about $12,-000,000, at 2¾ percent, to the Cunard Steamship Company for the building of the two greatest and fastest steamships in the world, and at the same time approved an annual subsidy of $1,100,000 for twenty years from which the loan could be repaid, the Parliament was placing an absolute barrier across the path of the development of a great trans-atlantic American steamship service without some equivalent aid from the United States. Yet it did not occur to any American official to interfere with this new and formidable British maritime procedure or to suggest that it was nobody's business, except the business of the British government and people themselves.

They do these things differently in America and in Great Britain. Sir Auckland Geddes saw no reason why he should not follow up his Minneapolis address with other addresses in various parts of the United States. What Senator Watson quoted Sir Auckland as saying in his Chicago speech was something to the effect that the United States, having two-thirds of the gold in the world, might well employ the service of British ships in part payment of debts which Great Britain owed us. Later, I believe that the British Ambassador pleaded that his actual words were misunderstood—that he did not utter exactly this language. But there has been no disclaimer whatsoever of the very much more aggressive and insistent previous statements at Minneapolis.

There has been a great deal of recent talk about alien propaganda against the American merchant marine. There are those persons, American and otherwise, who are given to insisting that there is not and never has been such propaganda in America. Senator Watson manifestly is one of those who are of a different way of thinking—and when he spoke in dignified but emphatic criticism of the activities of Sir Auckland Geddes he also referred to the outspoken

arguments against the American protective law that were being proclaimed by the Italian Ambassador, Signor Ricci. It may or it may not be a mere coincidence that shortly after Ambassador Ricci also departed from the shores of the United States.

Shipping Bill Unpopular in Foreign Countries

Americans who receive copies of the European press can have no doubt whatever in their minds that the American shipping bill is exceedingly unpopular in the commercial ports and the seats of government on the other side of the Atlantic. Every week brings accumulative evidence of this fact when the issues, not of the sensational but of the solid, conservative European journals, are delivered on this side of the Atlantic. If Europe were able to dictate the division on President Harding's shipping bill in the American Congress, that measure would not receive a single vote.

It matters not at all, apparently, that the European nations —Great Britain first of all—long years ago themselves set the example of subsidizing or otherwise assisting their National shipping industries. American statesmen who can see in shipping subventions nothing more than "raids upon the treasury" never used more violent language in denunciation of our shipping plans than the journals of the maritime countries beyond the Western Ocean. They hate the American shipping subsidy bill because they fear it, as more than one of the assailants have had the frankness to declare. Thus *Syren and Shipping,* London, of March 8, 1922, laments that "There is cold comfort for British shipowners in President Harding's message to Congress supporting the proposals of the United States Shipping Board. Whether the desired subsidy will be forthcoming remains to be seen. It has been demanded before and not granted. But the present campaign for State aid is far more potent than its predecessors." Subsequently, on March 22, 1922, this same London journal, having studied the full text of the measure, adds: "An examination of the text of this 'Merchant Marine Bill, 1922' does not lead us to alter our views either as to the earnestness of its sponsors in their efforts to establish an effective mercantile marine, or the seriousness of the competition which would follow the inauguration of such a wide-reaching plan as is suggested."

President's Patience Strained

It is not improbable that President Harding had Sir Auckland Geddes' unwise Minneapolis utterance and the threatenings of the transatlantic press in mind when, in his recent letter to Mr. Mondell, floor leader of the House of Representatives, he said:

> "Let me point out what I believe to be a well-screened source of opposition to an outstanding and confident American course in this matter. No well-developed maritime power of the Old World is craving the development of our shipping. We cannot complain thereat. I confess an admiration for the national spirit which always thinks of the interests of the homeland first. I crave its manifestation here at home in solving this problem. Other nations know the value of sea carrying as an adjunct of trade, and the individual discouragement abroad to our worthy aims—a discouragement often insidiously disseminated here—ought to argue an American interest no longer to be ignored."

Our American President is the soul of patience and good humor. But he felt convinced that it was imperative to speak out when he framed these words—and the significance of them will not be lost upon the country. Those American citizens who read first the anti-shipping arguments of foreign origin and then peruse the arguments of those American statesmen from the inland States who are fighting the shipping bill in Congress cannot but be struck by the close similarity not only of the ideas but of the language of the foreign and domestic outgivings on this subject. Sir Auckland Geddes' protest that Great Britain never bestowed any shipping subsidies is echoed in identical language in the recent minority report from the Committee on the Merchant Marine and Fisheries. Yet all along the Atlantic and the Gulf coasts there are thousands of practical American shipping men who know very well the history of the Cunard Line, of the Royal Mail Steam Packet Company, of the Peninsular & Oriental and of other National steamship services which connect the United Kingdom with the chief ports and markets of the world. These men all know that it is as accurate and just to say that Great Britain never granted steamship subsidies as it would be to declare that the United States never had any system of protective tariffs! A British Ambassador may "get away" in Minneapolis with an assertion that such things as subsidies to ships have never been known in the United Kingdom—but in Boston, or New York, or San Francisco such a remark would merely win for Sir Auckland the reputation of being an unconscious humorist.

Europeans Know Bill Will Help American Shipping

Those editors, shipowners and shipbuilders of Europe who are openly carrying on a propaganda against the American shipping bill have an undoubted right to protest against American shipping legislation—in their own newspapers, their own ports and at a distance. They know as well as do American shipping men that this proposed bill of President Harding is a formidable measure—that it will most certainly result in a substantial increase of the American merchant marine and naval reserve, and that it will operate to promote American commerce and to strengthen American resources for the National defence.

For their own reasons these gentlemen would, of course, prefer to have America continue to be weak upon the seas. But our kin and friends of Europe have no shadow of a right to make any effort to project their propaganda, through their diplomatic representatives or otherwise, to American soil, be it in Minneapolis or Chicago or Washington. In our own country this problem of the American merchant marine is a problem to be settled by the American people and their Senators and Representatives in Congress, without foreign advice and without foreign interference.

Former German Interference Proved

During the years preceding the world war there was a very open and conspicuous propaganda in this country against any effort whatsoever to strengthen American ocean shipbuilding and navigation. The Gallinger shipping bills in particular were violently opposed in the American press throughout the country by statements made directly by the official heads of the great German steamships companies, the North German Lloyd and Hamburg American. Unquestionably these arguments had a certain effect, particularly on the considerable "German vote" in the Middle West and in Congress. The full character and extent of this German propaganda could not at that time be ascertained by those who were interested in the development of the American merchant marine. But when the United States itself entered the world war in 1917, our government seized the head offices of the German steamship magnates in New York, and in these offices confiscated great quantities of correspondence, including, it is understood, letters that had passed between these German magnates and their hired agents and representatives in Washington. These records are now in the possession of the United States Shipping Board or of the Department of Justice.

What was conjectured is now known to be a fact, that the heads of these Teutonic corporations had their men in Washington to report upon all developments calculated to upbuild an American merchant marine, and that instructions were given as to how these efforts could best be defeated—as they were defeated by a very narrow vote, from States where the German element was strongest.

British Interests Warned

All this is history now—it is of the past. But I would venture to suggest to perhaps overzealous representatives and

agents of British steamship interests and their "listening stations" in this country, that it would not be exactly a comfortable thing, if it developed that there were a widespread British propaganda here against President Harding's present effort to upbuild American shipping. The American people, because of events preceding and during the world war, have learned to be exceedingly resentful of alien propaganda of any kind. They frankly did not like the recent utterances of Sir Auckland Geddes, as Senator Watson's effective protest has shown. It would be most unfortunate for the continuance of good feeling between the American and the British peoples, if there were any further developments along this line. For it is just as unwise and just as grave an impropriety for British interests of any kind to meddle with the course of American legislation, especially pertaining to the merchant marine, as it would be for American interests of any kind to seek to interfere with the efforts that are constantly and properly being made in the British Parliament and by the British Board of Trade to strengthen further the already formidable power of British shipping.

One point in particular our British kinsmen, if they are real friends of ours, will carefully bear in mind—and that is that the recent Washington conference on the limitation of armaments solemnly agreed that the battleship fleets of the United States and of Great Britain should hereafter be equal, and that the battleship fleet of Japan should bear to them both a relation as of three to five. That agreement is being faithfully carried out, so far as the actual fighting units are concerned, by the three nations most vitally interested. But there should be no need of reminding the British government and people, of all governments and peoples, that effective naval strength is not a mere matter of battle line alone—that there must also be an adequate, effective merchant reserve behind it. As Admiral William S. Sims has lately and wisely said, "The navy of the United States would be of very little value as a defence of the United States and our possessions, if it were not for the merchant marine."

The American aspiration for the possession through National aid of an adequate merchant marine and naval reserve is an instinctive sequel of the Washington conference, without which a great purpose of that conference will be nullified so far as concerns America herself. Our nation requires a proper merchant fleet for the safeguarding of our commerce and also as a vital resource of the National defence—and any effort, direct or indirect, on the part of a foreign government and people to thwart America's aspiration along this line ought to be understood on both sides of the Atlantic to be an effort so unfriendly that it should be inconceivable.

Further Attempts to Delay the Ship Subsidy Bill

Responsibility Rests with Congress—President's Attitude Unchanged —Sentiment in Middle West Favoring Ship Subsidy Grows Stronger

By Harold F. Lane

Washington, D. C.

OPPOSITION among Republican members of the Senate to the efforts of the President toward prompt and favorable action on the ship subsidy bill has made its appearance since consideration of the bill in the House was postponed in order to enable the House to take an adjournment to August 15. A recent canvass of the Republican senators, although the exact results were not announced, is said to have developed the fact that there is a strong sentiment against bringing the measure up this summer, and at a recent meeting of leaders of the Senate at the home of Senator Lodge of Massachusetts, steps toward side-tracking the bill were discussed. Among those present, agreement was reached in favor of postponing the bill until after election and while the President was away at the time it is understood that the results have since been reported to the President by Senator Lodge.

President Harding has been so busy of late in his endeavors to deal with the coal and railroad strikes that he has been unable to give very close attention to the prospects of the shipping bill but undoubtedly he is being subjected to considerable pressure to alter his determination to call an extra session of Congress, if the bill is not acted on at this session. There is also the strong probability that the disposal of the tariff and other pending legislation will be allowed to consume so much time that only a short period would in any event be left available for a special session before the new session begins in December. The President has let it be clearly understood, however, that responsibility for the delays rests squarely upon the heads of Congress.

Attitude of the Middle West

The legislative situation in the Senate is advanced as the principal reason for postponing the subject but it is also obvious that senators from the middle west are still somewhat sceptical as to the popularity of the bill and are therefore afraid of it before election, especially since it has been complicated by the controversy regarding liquor selling on board American ships. The weekly bulletin of the National Merchant Marine Association points out, however, that "The argument is still advanced by the advocates of delay that the interior is opposed to aid to the merchant marine, but nothing tangible is produced to back up the claim. It is still true that not one commercial organization in the United States has gone on record as against the shipping bill while hundreds have come out in advocacy of it. The sentiment of the press is growing stronger, a number of papers that have not hitherto taken a stand either way have declared editorially for the proposed legislation, and some that have been against the measure are now for it. In the farm press is found the bulk of the opposition but in most every instance the character of the comment on the situation shows that hostility to the bill is based on a misunderstanding of its purposes and effects."

Many representatives of the agricultural interests that have been inclined to oppose the bill are said to have received "a new slant" on it as a result of a meeting at the White House on June 28 at which President Harding explained to a number of representative farm leaders the reasons why he thought the farmer should support the proposed legislation. For two hours the President answered the questions of his guests and he was assured that every effort would be made to make clear the principles of the bill to the farming population.

While all of those present were not willing to admit that they were convinced it was learned that many misunderstandings were cleared up that had previously been the cause of much of the opposition.

A special committee of the National Industrial Traffic

League, which is regarded as the most representative organization of shippers in their relations with railroads and transportation generally, has made a study of proposed changes in the maritime laws and has recommended to the executive committee of the league that the organization favor the passage of the ship subsidy bill and the repeal of Section 28 of the Jones law.

The fact that the Democrats are not prepared to make a party stand against the bill was indicated when the minority report of the House committee on merchant marine and fisheries on the revised bill was filed on June 27. Of the seven Democrats on the committee, only three endorsed the report in full, Representatives Davis of Tennessee, Hardy of Texas and Bankhead of Alabama. Representatives Bland of Virginia and Briggs of Texas signed a postscript to the report stating that they were "substantially in accord with it and opposed to the bill," while Representative Lazaro of Louisiana and Cullen of New York failed to sign the minority report.

Hearing on Liquor Sales

The vexed question as to the legality of sales of liquor on American vessels outside the three-mile limit was given an exhaustive public hearing before Attorney General Daugherty and officials of the Department of Justice on July 13 as the result of a request from the Secretary of the Treasury for an opinion on the subject. Chairman Lasker, not wishing to agitate the subject, had not previously asked for an opinion from the Attorney General but had acted on the advice of his own counsel in the matter. The hearing was on two points, as to whether the eighteenth amendment and the national prohibition act prohibit possession, sale and transportation of intoxicating liquors on American ships on the high seas, and as to whether foreign vessels may bring liquors as ship stores within the three-mile limit. The Shipping Board was not represented at the hearing, although a copy of the opinion of General Counsel Schlesinger was filed. Arguments were made on behalf of the American Ship Owners' Association, the Anti-Saloon League, the Prohibition Bureau and various other organizations.

Bill to Reduce Shipping Board

Senator Borah of Idaho has introduced a bill in the Senate to reduce the number of commissioners of the Shipping Board from seven to three, for the purpose, he explained, of saving four $12,000 a year salaries. One of the effects of the bill would be to break up the present system whereby representation on the board is assured to all sections of the country, the appointments being on a geographical basis. The Borah bill provides that the President should not name more than one commissioner from any state nor more than two from the same political party.

(Photograph by Kadel & Herbert, N. Y.)

Launching a Fighting Seaplane from the U. S. S. Maryland by Means of a Newly Developed Catapult

So successful have the tests demonstrated the launching of a plane from a battleship by a catapult, that each of Uncle Sam's battleships will be provided with fighting planes and a catapult to launch them from her deck. The United States is the sole possessor of this practical plane catapult.

Recent Developments in Marine Insurance

Barge Canal Pool—Hull Conditions Bad—Suez Canal Recognizes Our Classification—Radio Guides Ships—Oil Burning Recommendations — New English Average Rules — Cuban Conditions

By "Bordereaux"

IN harmony with the popular agitation for a more extensive use of the New York State Barge Canal marine underwriters are co-operating in a movement in conjunction with State officials that should result in attracting traffic through a substantial reduction in insurance rates on hulls and cargoes routed via the canal. The proposition is to form a syndicate of underwriters who will cover on the canal provided the State authorities inaugurate certain improvements and safeguards that should increase efficiency and transform the customary underwriting loss into a perceptible margin of profit. The insurance companies have been regularly losing money on their writings on the barge canal, chiefly because of the large number of strandings in the narrower parts. State Superintendent of Public Works Cadle has been conferring with the underwriters and has expressed a willingness to meet them half way in the improvements suggested by them. These improvements take the form of additional safeguards to navigation; such as buoys, efficient lock approaches and the expansion of wrecking, dry-docking and repair facilities. Substantial rate reductions will be granted by the underwriters when these improvements have been made. It is only fair to the insurance men to state that they are as anxious as any other class of New Yorkers to attract shipping to the canal through the practical medium of lower costs.

In this connection it might be added that the underwriters are taking a cordial interest in the plans now being perfected for a line of seventeen motor barges for use in the canal and Great Lakes, by which it is planned to make possible extensive shipping operations between New York and Duluth without breaking bulk. A company is being organized to produce and operate the fleet as soon as additional capital has been subscribed. Theodore D. Wells, a prominent naval architect, is the designer. The American Bureau of Shipping has been asked to class them when completed. Each barge is to have a cargo capacity of one thousand tons, will be of steel, 220 feet in length and with a Diesel electric drive. Seaworthiness is to be the special consideration, for it is proposed not only to use these barges on the Great Lakes during the navigation season but to employ them in the coastwise trade for the remaining four months of the year.

Hull Conditions Bad

ONE of the safest marine insurance authorities of England is Sir Edward Mountain, chairman of the Eagle, Star & British Dominions. In an address to the stockholders of that company he recently declared that hull conditions in general continue to be extremely unsatisfactory and that claims for repairs, directly or indirectly, absorb the majority of the premiums. Under the old Hull Agreement the companies had enjoyed a reasonable average profit, but when that went to pieces last year disaster set in. Increasing competition and the reduction in values induced certain underwriters to withdraw at that time and the combination could not be longer maintained. After a year of wide open competition the full extent of their folly may now be measured. Premium receipts have gone off from forty to fifty percent, taking into consideration the reduced values on which the steamers were placed.

"In my opinion," said Sir Edward, "such a reduction was absolutely unwarrantable and could hold no prospect whatever of profit, but only a certain loss; in consequence of which, much to our regret, we refused to renew the bulk of this business, even although by so doing we gave up connections we had had for a great number of years."

Suez Recognizes Our Classification

IT has been a great satisfaction to American underwriters, as doubtless to all others of their countrymen, to have the authority of the American Bureau of Shipping accepted by the Suez Canal Company. Not but that it ought to be recognized as well there as elsewhere, but because considerable serious trouble has been obviated by the Suez authorities granting a belated inclusion of our national classification society among those of other countries. It will be remembered that the Merchant Marine Act of 1920 made the Bureau the official classification society of the United States. What, then, was the amazement of our underwriters and shipping interests to learn that the recently promulgated order of the Suez Canal Company ignored the Bureau altogether in its designation of classifications under which tank steamers carrying bulk oil and gasoline would be allowed to make use of that important waterway. That order included only Lloyds, the Bureau Veritas, German Lloyds and the British Corporation of Glasgow, as classification societies under which that type of vessels passing through the canal could be certified. It is estimated that, had this order stood, it would have denied the canal to more than 900,000 tons of American vessels, including those of the United States Navy. As good luck would have it, Stevenson Taylor, president of the American Bureau of Shipping, was at the time in Europe on a visit of inspection of the society's Continental agencies and he was promptly cabled the news and at once got in touch with the Suez authorities and had the assurance given him that the order would be instantly corrected to include the Bureau. It was declared to have been an oversight. Classification is required of tank ships in order to make sure that certain technical details of construction have been complied with so that accidents may not happen that would possibly block the waterway.

Radio to Guide Ships

MARINE underwriters are taking the liveliest interest in the announcement of Signor Marconi that radio can be utilized to guide vessels in fog and storms. The great inventor made such conclusive demonstrations of the possibilities of the short wave, in his recent address before the American Institute of Radio Engineers, that insurance men are confident that it is only a question of a few more developments before this great agency of protection will become commercially available. The time has passed when anyone questions the conclusions of the inventor of wireless. Signor Marconi illustrated his points by the use of a toy apparatus that sent across a space of twenty feet. He said that the possibilities of the short wave have been universally neglected but that they are capable of as high a development as the long distance waves of

hundreds and thousands of meters in length. He demonstrated that a shaft of radio waves might be reflected in any desired direction, as light from a mirror, and that in this manner a lighthouse could guide a ship through a dangerous channel in fogs and storms. With waves of three and a half meters he has reflected radio signals six miles and waves of fifteen meters have been reflected for ninety-nine miles.

New English Average Rules

AT the recent annual meeting of the English Association of Average Adjusters a new rule of practice was adopted with respect to the contributory liability in general average of ships' stores, bunker coal or fuel. It is as follows:

That underwriters insuring ships' stores, bunker coal or fuel, destroyed or used as part of a general average operation, shall be only liable for those articles as a direct claim on the policy when they formed part of the property at risk at the time of the peril giving rise to the General Average Act.

Adoption was also accorded the following probationary rule:

That in practice, for the purpose of ascertaining the liability of underwriters for contribution to general average and salvage, deduction shall be made from the insured value of all losses and charges which constitute a deduction from the contributing value and for which the insurer is liable.

Oil Burning Recommendations

ONE of the important points recommended in the report of the Marine Fire Hazards Committee, recently adopted by the National Fire Prevention Association, has to do with oil burning equipment on vessels. It reads as follows:

It is strongly recommended that systems whereby oil is pumped from the tanks to the burners be used; but in cases where a pumping system is deemed impracticable and the use of gravity feed is desired, special permission shall be granted installation and detailed plans submitted and approved.

Pumps shall be in duplicate, of an approved design, well secured against leaks under a test pressure 50 percent in excess of the designed pressure of the system carried.

Whether pumps are located inside or outside of the fireroom, gear shall be installed for operation from deck of stop valves on each tank and throttle valves on both service and booster pumps. This provision does not apply to fuel pumps on motor vessels.

On steam vessels burning oil of a flash point lower than 150 degrees F., closed cup, the pumps handling such oil shall be located in a compartment separated from the rest of the machinery space by gas-tight bulkheads and accessible therefrom only by a gas-tight door.

The piping and spindles of fireroom controls shall be made gas-tight where they pass through the pump room bulkheads.

This pump room shall be provided with induced ventilation always sufficient to reduce the pressure therein slightly below that in the compartment from which entry is made.

Cuban Conditions

ALTHOUGH port conditions at Havana are greatly improved and shipments are now passing through the Custom House and being removed by consignees within five days after the arrival of vessels, there still remain many sensational evidences of the astonishing congestion that prevailed there a year ago and these continue to disturb economic conditions. Forty-nine warehouses contain more or less of them and this merchandise appears to be without owners and will eventually be sold at auction by the Cuban authorities for the payment of fees and other charges that have accumulated upon them. It is being asked, "What is to become of these goods before the Cuban Government disposes of them and what is to be the position of the marine underwriters in the controversy?"

Albert R. Lee, E. A. Palmer and Mr. Amberg, counsel, of the admiralty firm of Harrington, Bigham & Englar, compose the group that is negotiating in Cuba on behalf of the underwriters. They have found a very complete pilfering of cases of merchandise of every description. Worthless rubbish of a weight rudely approximating the former heft of the goods filled the cases and sometimes there was nothing at all in them. It is not believed that the responsibility for these losses will fall upon the underwriters but rather upon either the shippers or the consignees, as the facts shall develop upon legal inquiry. It appears that many stevedores and dock workmen whose wages came to them at uncertain intervals tided their financial necessities over by helping themselves to such merchandise as appealed to their fancy. In one instance a shipper called in an authority to advise him as to his position. He had shipped forty-three cases of goods to Cuba a year ago and only recently took steps to re-ship the merchandise back to the United States. He found forty-one of his cases absolutely empty and the other two partially pilfered.

One of the chief sources of loss to Americans has been the notoriously inefficient packing they employed. Such inherent defects were found to obtain much more frequently with American shipments than with those that had come from Europe.

English Insurance Conditions

ADVICES from the United Kingdom and the first-hand observations made there by recently returned visitors from the United States all tend to show the same slackness of the marine insurance market that has given so many of our own underwriters anxious hours these many months past. The underwriting room at Lloyds is said to be only sparsely populated nowadays and many of the leading company officials find little occasion to run up to town. Next to nothing is being written and what is placed is at rates absurdly low. It has been discovered that the brokers, both in the British Isles and in America, have been decidedly more alert than the underwriters and have secured acceptances at rates much lower than conditions justified. Only now the insurers are awaking to the situation and are beginning to demand something more equitable in rates. The tendency from now on is said to be decidedly in the direction of better quotations. It is also of interest to learn that the British underwriters have been realizing a nice profit upon their American business. Hull rates have been so low, and the valuations so enormously reduced, that many of the more astute underwriters are declining to accept further business at prevailing figures and prefer to let business go, even though it has been on their books for years, rather than face a certain loss with no possible hope of profit. Raiding of rival office accounts continues there, as here, to be the leading summer pastime. Now and again a prominent company is found announcing that it has decided to abandon direct writing altogether for the time being. Certainly, few men in marine insurance today have ever known the market to be so slack or so replete with discouraging conditions.

Would Insure a Ship's Life

CERTAINLY the Germans are nothing, if not ingenious. A group of savants of that country is engaged upon a scheme for the application of life insurance principles to such inanimate objects as ships and houses, and several companies have been formed at Berlin and Hamburg for the effecting of this class of protection.

Simplification—Has It a Place in Shipbuilding?

By N. C. Wiley

The urgency of the need for reducing American shipbuilding costs needs no elaboration and the following is a suggestion of the possibilities of a new and untried step in this direction.

STANDARDIZATION is a term which, when applied to shipbuilding, has entirely different meanings for different persons and therefore the term as used in this article must be defined. Standardization, as used herein, means the development, by a shipbuilder or by the industry as a whole, of a standard line of fittings or ship parts. It is far from the writer's intention to urge standard design of ships and yet this is the construction frequently given the term. As yet standardization, although practiced to a greater or less extent in all shipyards, has not been unified by either builders or owners. No successful or thorough attempt at such standardization has been made by any large group or organization.

Simplification is a development of standardization by elimination which can best be defined by examples. If a line of cleats is designed in ten sizes for one type, six sizes of a second type and three sizes of a third, and these cleats do away with the necessity of further cleat design whenever a new ship is built, standardization has been attained. Now, if the first type can be reduced to five sizes, the second to three, the third eliminated and still all necessary requirements met, we have simplification.

> *"We have probably the highest ingenuity and efficiency in the operation of our individual industries of any nation. Yet our industrial machine is far from perfect. The waste of unemployment during depression; from speculation and overproduction in booms; from labor turnover; from labor conflicts; from failure of transportation, fuel and power supplies; from excessive seasonal operation; from lack of standardization; from loss in our processes and materials—all combine to represent a huge deduction from the goods and services that we might all enjoy, if we could do a better job of it.*
>
> *"One hundred percent is never possible in the material world, but the primary duty of organized society is to enlarge the lives and increase the standards of living of all the people, not of any special class whatever. The opportunity for advance in living standards lies more surely in the steady elimination of these wastes than in great inventions."*
> —Herbert Hoover.

If patterns are made for valves in cast iron, cast steel and composition for high, medium and low pressures in angle, globe and cross types in sizes at every half inch from ½ inch to 6 inches, then at every inch to 12 inches, there would be 286 valves and standardization would be nearly attained. If by combination, elimination, compromise and agreement this line can be reduced to sixty varieties, that is simplification. If the same yoke is used for a certain six of the valves instead of two yokes for the six, that is further simplification.

Simplification is the final step in standardization and it is that step in which lies the most economy. It is only simplified standardization that will effect a material reduction in costs. Yet it is this final step that is the hardest to take, requiring the most co-operation, thought, patience and foresight.

Satisfactory Solution Possible

Everyone who has to do with ship fittings tries to standardize and to simplify but meets with so many difficulties that the result is far short of perfection and by individual effort no satisfactory and abiding solution is possible. This situation is not caused by any lack of skill or interest on the part of shipbuilders' technical staffs. To establish a complete standardized line of both hull and engine fittings would take time and concentration on the part of experienced men, but there would be nothing impossible about it. The failure has been due to the fact that operators, marine superintendents, port engineers and inspectors have not adopted the same standards and refuse to recognize the builders. This refusal may be justified, as it is obviously possible that so-called standards may be poorly designed and not of a quality to give satisfaction. At times, however, it seems a mere matter of upholding a difference of opinion or of improperly written specifications.

The difficulty was aggravated by the boom of two years ago, but has always existed. The necessity of a solution is more acute in the reaction of today than ever before in the checkered history of the American merchant marine. For operators to maintain a technical staff large enough to criticize and check the plans of every detail of construction and to incorporate in the specifications a detailed description of all systems and individual fittings is at present often considered necessary. This is a burden to the owner in office overhead, in expense passed on to the owner by the builder, in delayed completion, disputes and in diversion of the staff from a more important duty—inspection of workmanship. The expense and folly of submitting detail plans for approval are not fully realized by the average operator. He is a business man with no time to verify the assurance given him that a satisfactory ship can not be obtained in any other manner.

Typical Examples

Before the war, a company building two ships specified and insisted on having rigging screws several sizes larger than the builder had hitherto used on the given sizes of rope. Furthermore, the rope was iron and of less strength than steel rope of the same size. Comparisons with manufacturers' quoted strengths, builders' and navy standards, classification requirements, mathematical analysis, all were of no avail; the representative's experience taught him that the specified sizes were necessary. If this were so, ships are in service with rigging screws which are too small.

Ships for two owners were being built from the same plans. The naval architect for the smaller fleet must have the male and female sockets on his goosenecks and gooseneck bolts reversed from the builders' patterns and the other owner's standard practice. Only recently, and on a rush job, specifications for a flanged copper pipe steam heating system were issued for alterations to one of a large class of ships now fitted with steel pipe and screwed fittings. Neither flanges, tees, laterals nor valves for this purpose were obtainable, with the result that steam heating was the point about which contract delivery was made to hinge. The point here is not so much the relative merits of steel and copper as that a system should be asked on a rush job which was so unusual that neither manufacturers nor a large shipbuilder were in a position to supply the fittings. If such a revolutionary change is desirable, should it not be first the subject of general discussion and mutual agreement?

Only in June a plant which had tried for a month to obtain a 4½-inch high pressure cast steel cross valve had to make one because of the existence of 4½-inch lines in a ship being reconditioned.

The above are just samples taken from the inexhaustible list of cases where simplification has been prevented. It is largely due to the lack of a universally recognized and agreed upon standard of size and type. It has seemed in the past to those actively engaged in the design and ordering of ship fittings that there was no way out of this dilemma. Happily, this is no longer the case. The way out lies in following a path already being blazed by many other industries, many of which are on the verge of a period of prosperity, while shipping is not.

Department of Commerce Interested

The shipping industry, in common with others, can now obtain the assistance of a new government agency as an aid in their solution—an agency started and actively supported by Mr. Herbert C. Hoover. The Bureau of Simplification of the Department of Commerce is referred to. The activities of this organization are increasing in their scope daily and are best described in the words* of Mr. W. A. Durgin, the director:

"The first step is to arrange for securing statistics, or other data, which shall show present conditions and indicate the line for action. For the machinery interests, the representative trade associations would appoint a small contact committee to get in touch with Secretary Hoover and the Division of Simplified Practice. After a conference at Washington, this committee would proceed to survey the machinery field for the Department of Commerce getting figures showing varieties manufactured and the importance of the several items during the last few years. The committee would summarize these data in a report covering present conditions, and would then forward the summary to the Division of Simplified Practice. With this report before it, the division would prepare a tentative list of representatives to the general conference—the personnel of the list being submitted to all trade associations interested and to the United States Chamber of Commerce, the American Engineering Standards Committee and other bodies, to insure that every factor in the field was given proper voice. All the representatives included in the final amplified list would then be invited to a conference in Washington and this conference would proceed to work out such recommendations for simplification as the general discussion should develop. The conference would further decide how frequently similar conferences for revision of the recommendations should be called; and each representative would engage to obtain the approval of his association, firm or other parent body, to the recommendations as finally adopted. Finally, the Division of Simplified Practice, for the Government, would give national standing and publicity to the action of the conference by issuing the recommendation as one of its official series. This series will be numbered in sequence and will be known as 'Simplified Practice Recommendations of the Department of Commerce.' As a part of its service the division will obtain a formal letter of acceptance of the recommendation from each of the bodies represented at the conference and, when necessary, from the individual members of those associations most interested. At regular intervals statistics from all manufacturers and distributors as to the percentage of business done in the simplified sizes will be requested and the division will accumulate data on necessary revision, calling the conferences for such revision at the times originally set by the industry."

It is surprising, that, in spite of the lessons taught by the lack of this very program in 1917 and 1918 and notwithstanding Mr. Hoover's well known interest in the American merchant marine as a necessary component of our foreign and domestic commerce, no shipping interest has as yet approached the Bureau of Simplification. In June the writer was assured that he was the first person to bring the subject to their attention. He was only a few minutes ahead of the beehive manufacturers and they were prepared to call a conference at once.

However, without either owners or builders taking any initiative, future ships are sure to undergo a great deal of simplification, although not enough. It is impossible to have conferences on simplification among the trade and manufacturers' associations of almost every conceivable material and article entering into the equipment and outfit of a ship and not have the effect apparent. Consider the following partial list of industries which have entered this campaign, some of them making their first move in May of this year, others being well advanced:

Asbestos products	Hardware
Automotive equipment	Instruments, electrical
Boilers, steam	Linoleum
Boxes and barrels	Cotton duck
Cordage and twines	Machine tools
Fabricated structural steel	Paint
Gas engines (inc. marine)	Plumbing
Refrigerating machinery	

By the time this article is published many other lines upon which shipbuilding is dependent will be reducing dimensional and color variation in their product.

What advantages will accrue alike to owners and shipbuilders? Some of them would seem to be:

1. Reduced cost of new and repair work due to savings in:
   (a) Design of details
   (b) Patterns, jigs, etc.
   (c) Unusable surplus material
   (d) Economy through quantity production
   (e) Idle equipment
   (f) Discontent among yard and office workers
   (g) Storeroom expense
   (h) Delays
   (j) Accounting
   (k) Estimating
   (l) Purchasing expense
   (m) Administrative expense.

The above are in addition to the savings made in the price, delivery and handling of purchased parts already undergoing simplification as previously noted.

2. Greater speed in both new and repair work.
3. More accurate and dependable workmanship and design.
4. Less expense to owners on account of technical staff having—
   (a) Simpler specifications
   (b) Less checking of detail plans
   (c) Less correspondence
   (d) Less overhead
5. Increased effectiveness and decreased cost of inspection.
6. Decreased expense in and increased possibilities of adapting purchased or leased ships to new operators' requirements.

There is no time like the present for the numerous organizations of owners, operators, builders and designers to let Mr. Hoover know that they are as alive to the opportunity now open to American industry as are other and allied trades. Once started, no harm and much good will result and lasting benefits accrue to all participants. It is as practical a form of subsidy as any that has been suggested!

*From *The American Machinist,* May 11, 1922.

S. S. Princess Louise on Trial

Canadian Pacific Coastwise Steamer Princess Louise

Luxuriously Equipped Passenger Ship for Coastwise Service of Canadian Pacific Railway Built and Engined by Canadian Shipbuilder

By R. Allan, B. Sc.,* and A. F. Menzies, M. I. N. A.†

THE recent addition of the palatial steamer *Princess Louise* to the coastwise fleet of the Canadian Pacific Railway Company draws attention to a very significant epoch in the history of Canadian shipbuilding. Previous to the war, no Canadian shipyard could have competed with any hope of success against the old-established yards of Great Britain; but the war upset all standards of economic values, raising the cost of shipbuilding in the old country to heights hitherto undreamed of. Hence when it was announced about eighteen months ago that the Wallace Shipbuilding and Dry Dock Company, Ltd., of North Vancouver, B. C., had booked the contract for this noteworthy vessel, it was obvious that the Canadian bid was strictly in accordance with prices received from the Clyde and Tyne.

In view of the fact that previous outstanding vessels of the Canadian-Pacific coastwise fleet had been built by such well known shipbuilders in Great Britain as the Fairfield Shipbuilding and Engineering Company, Ltd., Govan, Glasgow; Swan, Hunter and Wigham Richardson, Ltd., Newcastle-on-Tyne, and Bow, McLachlan and Company, Ltd., Paisley, Scotland, it was not surprising that skeptics marveled at the audacity of the owners in placing this contract with a relatively small shipyard. In Mr. Wallace, however, who is the active head of the Wallace Shipbuilding and Dry Dock Company, Ltd., Canada possesses a shipbuilder of the type of the Dennys, of the Lairds and other historic names of British shipbuilding. For nearly thirty years Mr. Wallace has been building ships in Vancouver, including fishing boats, fine stern wheelers for the lakes, tugs, ferries and more recently freight steamers such as the 8,350-ton *Canadian Highlander* and *Canadian Skirmisher*. Moreover, the workmen at the Wallace shipyard are in nearly every case trained shipbuilders, mainly products of the Clyde, Belfast and the Tyne. The results accomplished by such an organization can be seen in the successful completion of the vessel itself, which in beauty of design, luxury of equipment, decorative effect and all around excellence competent critics consider superior to anything in the fleet.

Main Particulars of the Vessel

The principal dimensions of the *Princess Louise*, which has been built under British Corporation rules to their highest class for sea-going vessels, are as follows:

Length overall	330 feet 0 inches
Length between perpendiculars	317 feet 0 inches
Beam, molded	48 feet 0 inches
Depth, molded	27 feet 6 inches
Draft forward	15 feet 0 inches
Draft aft	17 feet 0 inches
Mean draft	16 feet 0 inches

In the design of the vessel and its accommodations primary consideration was given to the Alaska run, but what are known as the triangular and local runs, viz., Victoria, Seattle and Vancouver, and Victoria-Vancouver, had also to be considered, more especially as regards fineness of form, necessitating a very fine block coefficient to maintain with economy the speed of the triangle run, viz., 16½ knots.

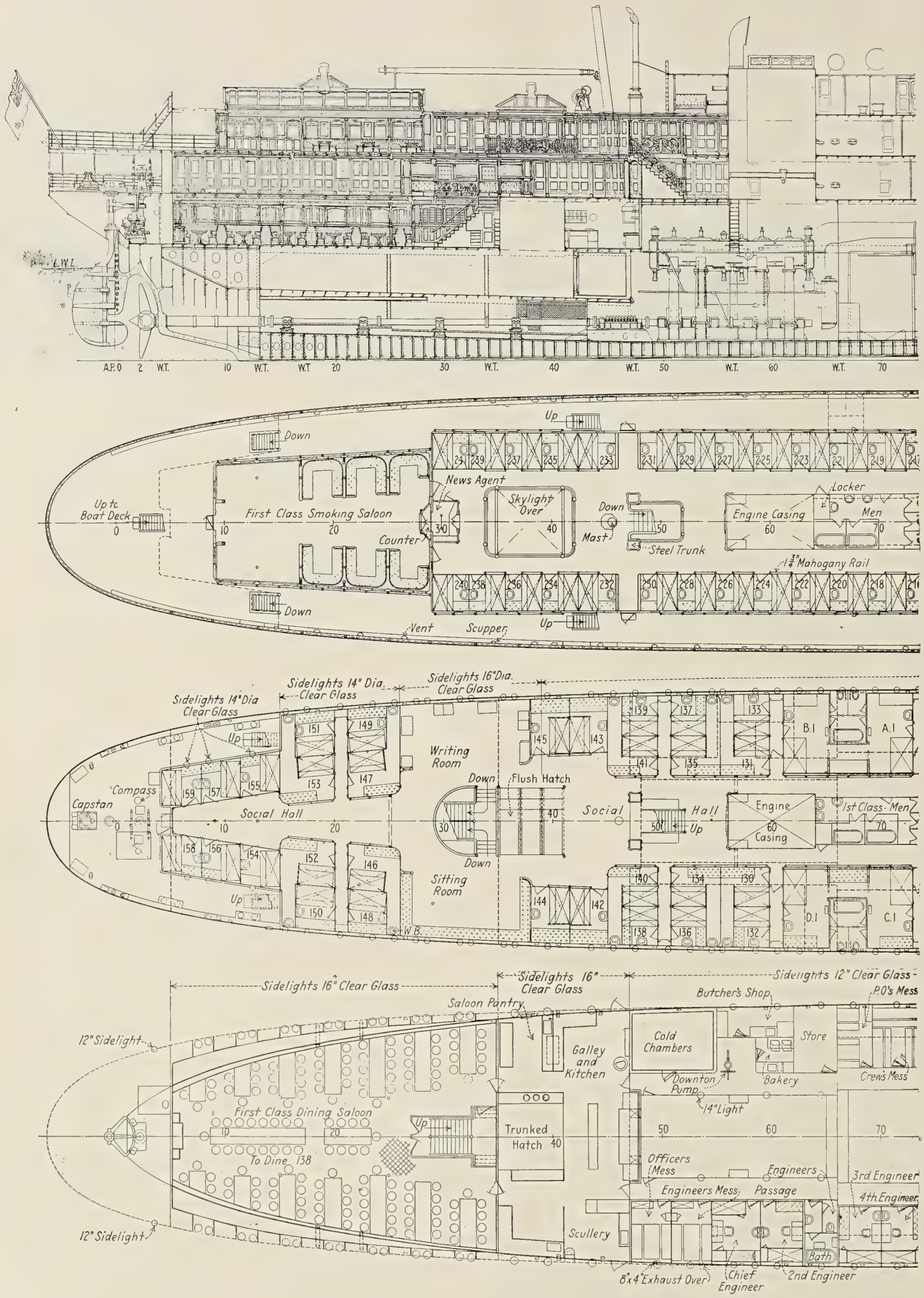
Nothing that pertains to the comfort and pleasure of the passengers usually provided on ocean liners has been omitted. Indeed the vessel, with her smoking rooms, dining saloons, observation room, library, suites de luxe, etc., can best be described as an ocean liner in miniature.

Owing to her fineness the vessel will carry only about 700 tons of cargo but her main deck forward has been provided with very large cargo ports, capable of allowing a large limousine to embark without having to take off the top hamper. Altogether this deck can hold about forty cars.

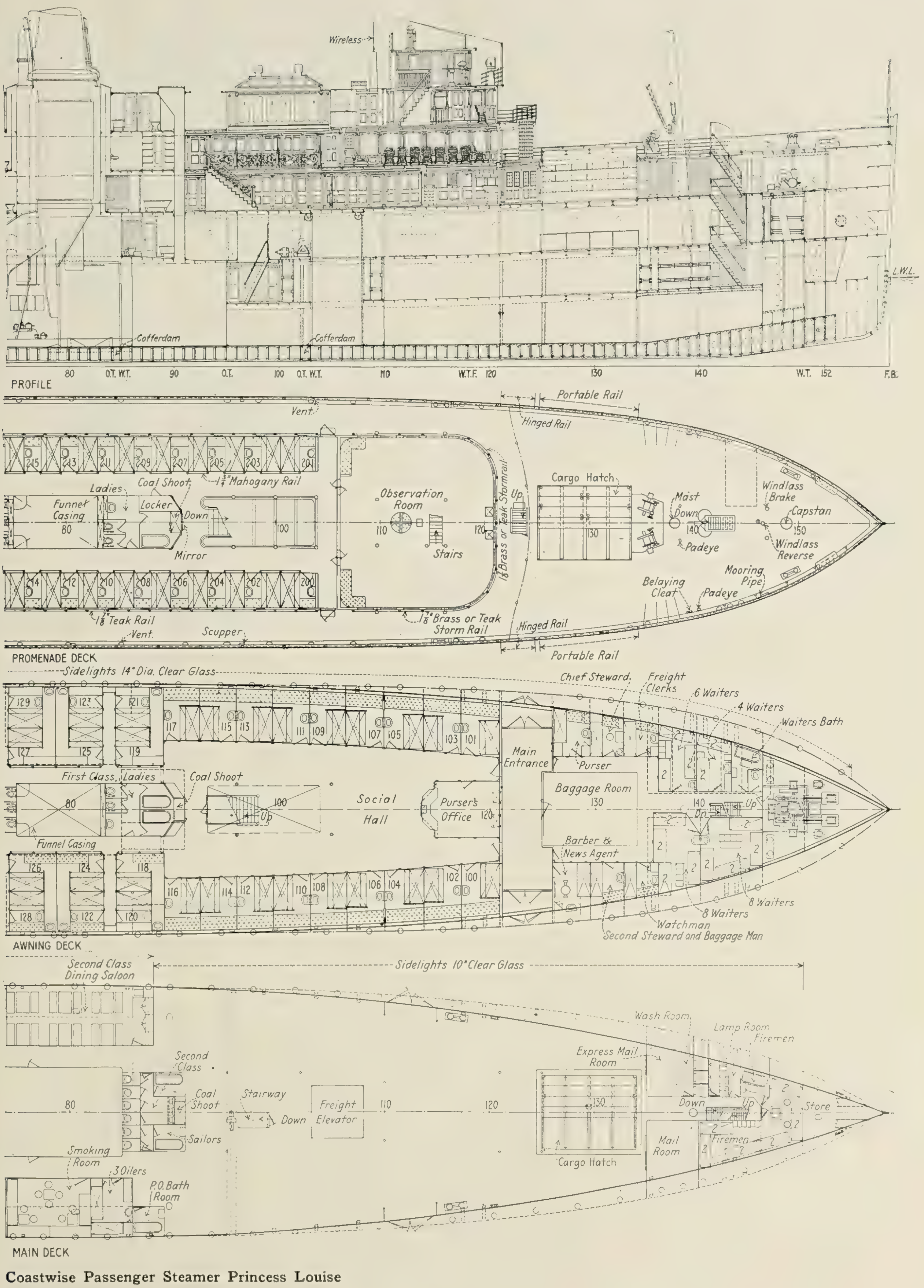
To facilitate the handling of freight, a freight elevator has also been installed forward on this deck. Aft on the orlop deck a cold storage compartment of about one carload capacity has also been provided, in addition to the usual cold chambers for the ship's provisions.

A very complete installation of cargo handling gear has

* General superintendent, Wallace Shipbuilding and Dry Dock Company, Ltd., North Vancouver, B. C.
† Chief engineer, Wallace Shipbuilding and Dry Dock Company.



Profile and Deck Plans of Canadian-Pacific



Coastwise Passenger Steamer Princess Louise

RIVETING SCHEDULE

KEEL... Treble Riveted Butts for ½ L. Double Riveted at Ends. Rivets Spaced 3½ Diameters
Double Riveted Seams, all Fore and Aft, Spaced 4½ Diameters

CENTRE GIRDER... Double Riveted Butts all Fore and Aft Spaced 4½ Diameters
Bottom Angles where Single, 5 Diameters
" " " Double 5½ "
Top " under Engines 5½ "
" " Elsewhere 7 "
Vertical " 5"x5" 7 " In each row
" " 3"x3" 5 "

DOUBLE BOTTOM... Frames and Reverse Angles to Floors Spaced 7 Diameters
" " " " in E. Space " 5½ "
" " " " at Tank Ends " 4½ "
" to Shell Plating in way of Fuel Oil Spaced 2¾ c/c
Reverse Angles to Tank Top Plating Spaced 7 Dias.
" " " " " " in E.S. " 5½ "
" " " " " in way of Oil Tanks Spaced 2¾ c/c
Vertical Angles of Intercostals and Side Girders Spaced 7 Dias.
Horizontal Angles to Tank Top and Shell Spaced 6 Dias. 5½ Dias. under Engines
Brackets on Open Floors Spaced 5 Dias.
Tank Margin Angles Spaced 5 Dias
" " " in way of Oil Fuel Spaced 2¾ c/c

MAIN FRAMES... To Shell Plating Spaced 7 Diameters
In After Peak " 5½ "
In Oil Fuel Tanks " 5½ "
Fore Peak for 47 feet Abaft Stem from Keel to Well above Load Line Spaced 5½ Dias.

TANK TOP:- Centre Strake - Double Riveted Butts all Fore and Aft Spacing 4½ Dias. ℄ 4½ Dias at Ends
" " Seams for ½ L. Single at Ends Spaced 4½ Dias.
Margin Plate... " " Butts all Fore and Aft. Seams Single Riveted Except in way of Oil Fuel Tanks which are Double Riveted. Spacing 4½ Diameters except in way of Oil Fuel Tanks where it is 2¾" c/c } Butts 2¾" @ Oil Tanks
Plating...... Double Riveted Butts for ½ L. Single at Ends
Seams Single Riveted except in way of Oil Fuel Tanks which are Double Riveted
Spacing 4½ Diameters except in way of Oil Fuel Tanks where it is 2¾ c/c

SHELL PLATING:- Strakes A.B.C D E.F.G and H. Double Riveted Seams all Fore and Aft Spaced 4½ Diameters except in way of Oil Fuel where Spacing is 2¾" c/c } Butts Treble to Double
Strakes J.K.L and M Single Riveted Seams, all Fore and Aft Spaced 4½ Diameters

DECK PLATING:- Awning Deck (Upper or Strength Deck) Stringer - Double Riveted Butts all Fore and Aft Spaced 4 Diameters. Plating - Double Riveted Butts for ¾ L. Single at Ends spaced 4 Diameters. Single Riveted Seams Spaced 4½ Diameters
Orlop, Main and Promenade Decks:- Stringers - Double Riveted Butts, all Fore and Aft, Spaced 4 Dias
Orlop and Main Deck:- Plating - Double Riveted Butts for ½ L, Single at Ends Spaced 4 Dias.
Single Riveted Seams, Spaced 4½ Diameters where Caulked. 5½ Diameters elsewhere
Double Riveted Seams at Crown of Oil Fuel Tanks Spaced 2¾" c/c
Promenade Deck Plating - Single Riveted Seams Spaced 5½ Diameters
All Deck Beams to Plating - Spaced 7 Diameters

ATTACHMENTS:- Beam Knees and Brackets, 5 Diameters Single, 7 Diameters Zig-Zag

DECK GIRDERS:- Double Riveted Butts Spaced 4½ Diameters
Deck Lugs Spaced 6 Diameters

BULKHEADS:- Frames to Shell 5 Dias. Boundary Angles to Deck Plating and Tank Top Spaced 4½ Dias.
Single Riveted Seams and Butts Spaced 4½ Diameters
Stiffeners, Ordinary Bulkheads Spaced 7 Diameters
" in Peaks " 5½ "
The Spacing of Rivets on all Bulkhead Stiffeners to be 4 Diameters for 15 per cent of their Length at each end

GUNWALE ANGLE:- At Awning Deck Spaced 4½ Diameters

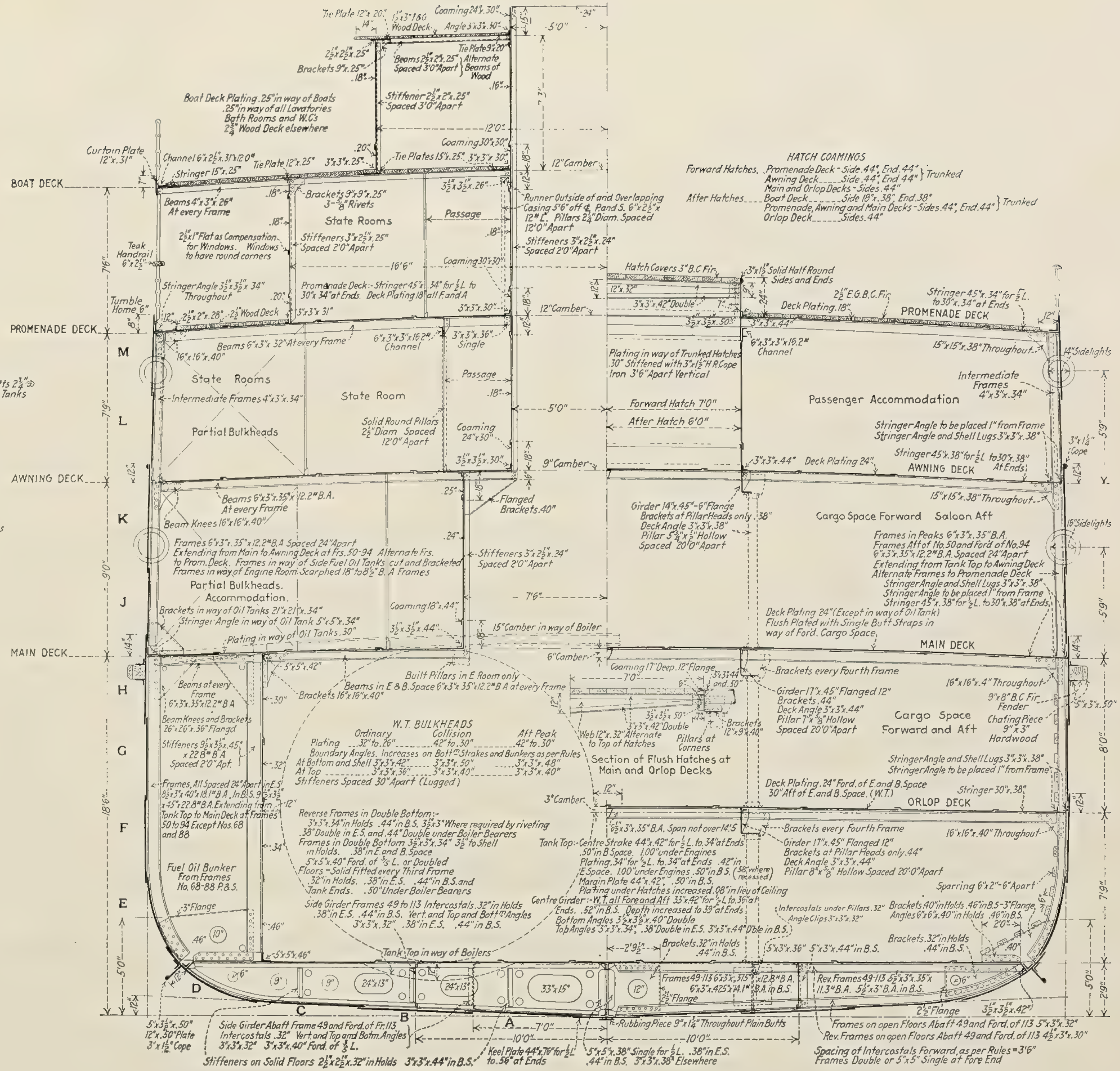
STRINGER ANGLES AND SHELL LUGS:- Spaced 5½ Diameters

CASINGS:- Butts of Coaming (where exposed to weather) Spaced 4½ Diameters
" " " (" not " " ") " 6 "
Seams " 6 "
Angles to Deck Plating (not exposed to weather) " 5 "
" " " " (where " " ") " 4½ "
Stiffeners " 8 "

SHELL PLATING

Overlapped
Strake "M"....34" for ½ L. to .30" at Ends
" L....34" " "
" K....46" " .34" at Ends.
" J....46" " "
" H....48" " .38" at Ends.
" G....48" " "
" F....48" " "
" E....48" " "
" D....50" " "
" C....50" " "
" B....50" " to .54" Ford. and .38" Aft
" A....50" " to .54" Ford. of ⅓ L. .38" at Aft End
Boss Plating .58"
Strakes "E and F" for 50 feet Abaft Stem Fitted with Doublings .44"-.36" (Owner's Extra)

STEM - 8"x2¼" Rolled Steel



SECTION THROUGH BOILER ROOM

Midship Section, S. S. Princess Louise

Canadian Pacific Coastwise Steamer Princess Louise

General Information

Service: British Columbia Coast Service.

Builder: Wallace Shipbuilding and Drydock Co., Ltd., North Vancouver, B. C.

Owner: Canadian Pacific Railway Co.

Characteristics

Length, overall	330′ 0″
Length, B. P.	317′ 0″
Breadth, molded	48′ 0″
Depth molded to main deck	18′ 6″
Draft, loaded	16′ 1¼″
Draft, light	
Block coefficient	
Midship section coefficient	
Longitudinal coefficient	
Speed, loaded, knots	17
Cruising radius, nautical miles	2,000
Framing	Transverse
Class	B. S.* with free board

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	
**Weight Propelling Machinery	
Deadweight Capacity	Grain 90,870 cu. ft. / Bale 79,720 cu. ft.
Displacement	

(In tons of 100 cubic feet)

Gross register	4031.91
Net register	1583.26

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

Anchors:
- 2 Bower, each 50 cwt. stockless
- 1 Spare Bower, 42½ cwt. stockless
- 1 Stream, 15 cwt., ex-stock
- 1 Kedge, 6 cwt., ex-stock

Chain:
- 270 Fat., 2″ stud link
- 90 Fat. 4½″ S. W. stream line
- 120 Fat. 4¼″ S. W. towline
- 2 Hawsers, 90 Fat., 7″ manila
- 2 Warps, 90 Fat., 6″ manila

Rudder

Area	91.5
Dia. Stock	10½″
C. Press. abaft C. L. pintles	

Complement

Deck officers	5
Deck crew	22
Engineer officers	4
Engineer crew	15
Purser's and steward's department	44
Total officers and crew	90

First-class passengers	300
Second-class passengers	44
Third-class passengers	10
Total passengers	354
Total complement	444

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	Steel	....	....
Derrick posts	.	....	....	....
Booms	4	Wood	5 Ton	34 ft.
	1	Steel	15 Ton	45 ft.

Deck Machinery

(Number, Size, Type)

Steering Gear, 1	8″x8″ Hastie
Windlass, 1	9½″x11″ Emerson Walker
Capstans, 1 aft	6″x8″ Emerson Walker
Winches, 4	7″x10″ Vert. Osc. Victoria Machy. Dept.

Life Saving Equipment

Lifeboats	No.	Type	Length
Lifeboats	10	Wood	24 ft.
Lifeboats	1	Wood	21 ft.

Propelling Machinery

Boilers

Number	4
Type	Single-ended Scotch
Length	12′ 0″
Diameter	16′ 0″
Furnaces	12-48″
Fuel	Oil
Draft	Natural and closed stokehold
Total heating surface, square feet	13,364
Total grate surface or furnace volume	
Superheat, degrees F	
Working pressure, lbs. per sq. in.	180
Normal fuel consumption:	
Per day, tons	
Per horsepower hour, pounds	
Normal steam production:	
Per hour per pound of fuel	lbs.
Total per hour	lbs.

Engines

Number	1
Type	4 Cyl. Trip. Exp.
Size	28″x43″x50″x50″—39″ stroke
Horsepower	3,678 at 136 R. P. M.

Propellers

Number	1
Type	4 Bladed
Weight	
Diameter	
Pitch	
R. P. M.	140
Projected area	
Developed area	

Auxiliary Machinery

(Number, Size, Type)

Machinery Space

Condensers	1 steel plate, 5,700 sq. ft.
Evaporators	
Distiller	
Filters	
Feed water heater	Weiss, exhaust
Fuel oil heaters, 4	Dahl

Pumps:
- 2 Main feed, 13½x10x21
- 1 Air, 12x22x15 dual
- 1 Aux. feed, 10x6x10 duplex
- 1 Fire, 10x6x10 duplex
- 1 Ballast, 6x7x7 duplex
- 2 Bilge and San., 6x6x6 duplex
- 1 Hot F. W., 4x2¾x5 duplex
- 1 Cold F. W., 4x4x5 duplex
- 1 15″ cent. circulating

Refrigerating Machinery

Peterbrotherhood, CO_2

Electric Equipment

Generators, 2	W. H. Allen 63 K. W.
Radio	
Emergency	

Holds

No.	Length	Hatches
1 Cargo	72′-0″	18′x14′
2 Cargo	30′-0″ (Freight Elevator)	10′x10′
1 Orlop	72′-0″	18′x14′
2 Orlop	21′-0″ (or 2nd class)	10′x10′
3 Orlop	58′-0″	12′x12′
Main Dk. Freight	88′-0″	18′x14′

and by Freight doors 9′-2″x7′-10″

Capacities

Cargo Space

Compartment	Grain	Bale
No. 1 Cargo hold	12,700	11,000
No. 2 Cargo hold	8,050	7,250
No. 1 Orlop deck cargo hold	12,700	11,170
No. 2 Orlop deck cargo hold	6,030	5,370
No. 3 Orlop deck cargo hold	16,190	15,360
Main deck freight space	35,200	29,570
	90,870	79,720

Refrigerated Space

Compartment — Cu. Ft.

In No. 3 Orlop deck cargo hold, 2,650 cu. ft. Also domestic cold store.

Bunkers

Compartment	Cu. Ft.	*U. S. Gals.
No. 3, Double Bottom	1,108	8,334 Port & std.
No. 4, Double Bottom	1,774	13,344 Port & std.
Side Cross Bkr.	6,446	48,484 Port & std.
Center Cross Bkr.	3,360	25,272 Port
Center Cross Bkr.	3,060	23,017 Std.
Aft. Side Bkr.	3,492	26,266 Port & std.
Ford. Side Bkr.	3,532	26,566 Port & std.

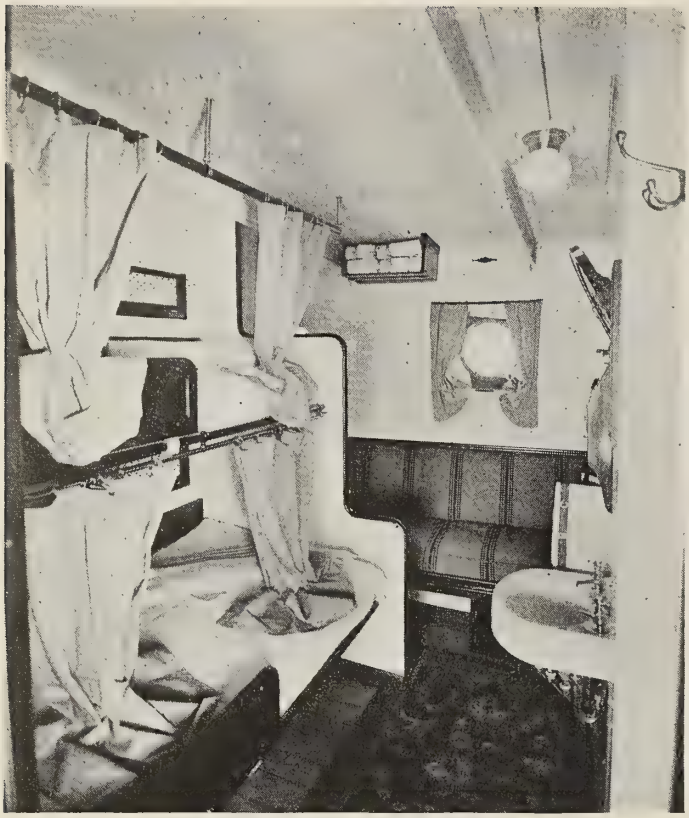
*39 cu. ft. per ton; 42 U. S. gals. per bbl.

Tanks

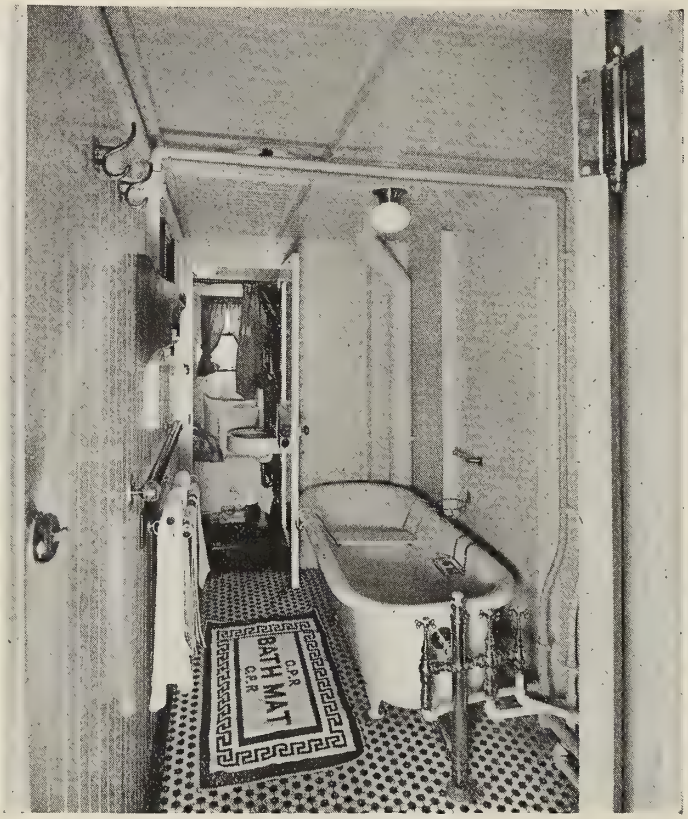
Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
No. 1	1,510		43
No. 2	1,720		49
No. 5	2,810		80
No. 6	1,410	39	
No. 7	920	26	
No. 8	950		27
No. 9	710		20
Fore peak	930		27
Aft peak	2,670		76
Total	13,630	65	322

Interior Views S. S. Princess Louise: (1) Library, On Bridge Forward; (2) Social Hall Aft, Looking Aft, Ladies' Sitting Room on Starboard Side and Writing Room on Port Side; (3) Observation Room Forward, Stairs Lead to Library Above; (4) Writing Room and Entrance to Dining Saloon in Social Hall Aft

Interior Views S. S. Princess Louise: (5) Smoking Room, Looking Aft; (6) Social Hall and Purser's Office Forward; (7) Dining Saloon, Looking Aft; (8) Special Stateroom, Finished in Bird's-Eye Maple Panelling



First Class Stateroom

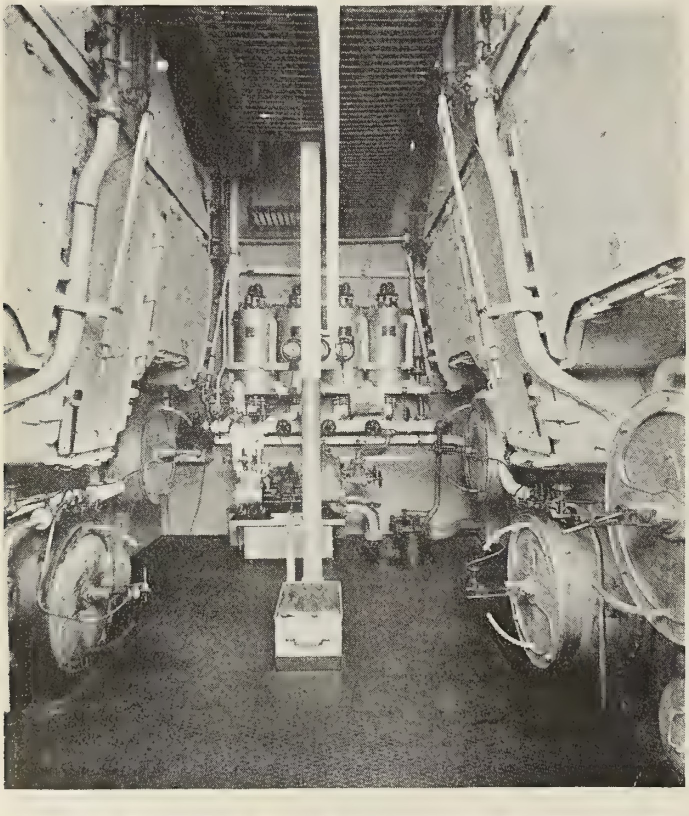


Private Bathroom

been fitted. There are four 5-ton booms, and one capable of handling 15 tons on the forward mast. The forward hatch is trunked between the promenade and awning decks, and has been so arranged that on the triangular or local run it can be used as a baggage room, the floor being arranged to hinge upwards.

The winches are of the vertical oscillating type, two winches being arranged so that they are handled by one man.

The vessel has very complete mooring arrangements consisting of two warping capstans and one windlass and is provided with wireless telegraphy.



Stokehold, Looking to Port, Showing Oil Fuel Arrangements

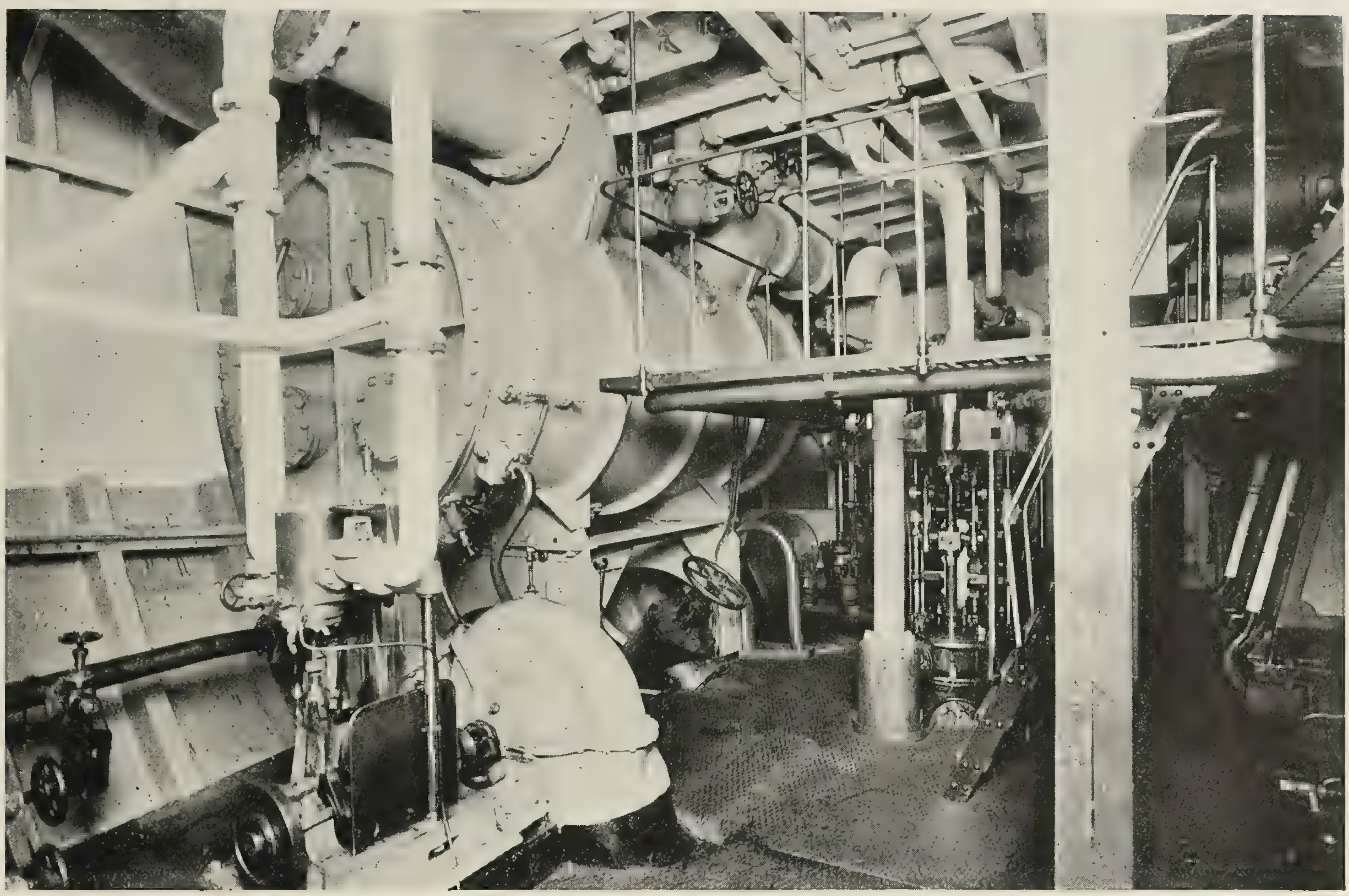
General Arrangement

As shown by the deck plans, there are three decks for first-class passengers and two combined freight and passenger decks. The boat deck contains twenty-nine two-berth cabins, two suites de luxe with separate toilets and combined bathroom. On this deck are also situated the library, with a staircase to the observation room below, the officers' cabins and wireless house. The captain's cabin is a particularly spacious and well-furnished room with a bay window. The library is very handsomely framed in Honduras mahogany with large plate glass windows commanding views ahead and on either side. It contains two very tastefully designed bookcases, with leaded glass panels, embodying Canadian dogwood as a floral motive. The floor is covered with a beautiful pile carpet and very comfortable cane chairs complete the furnishings of what is sure to become the most popular room on the vessel.

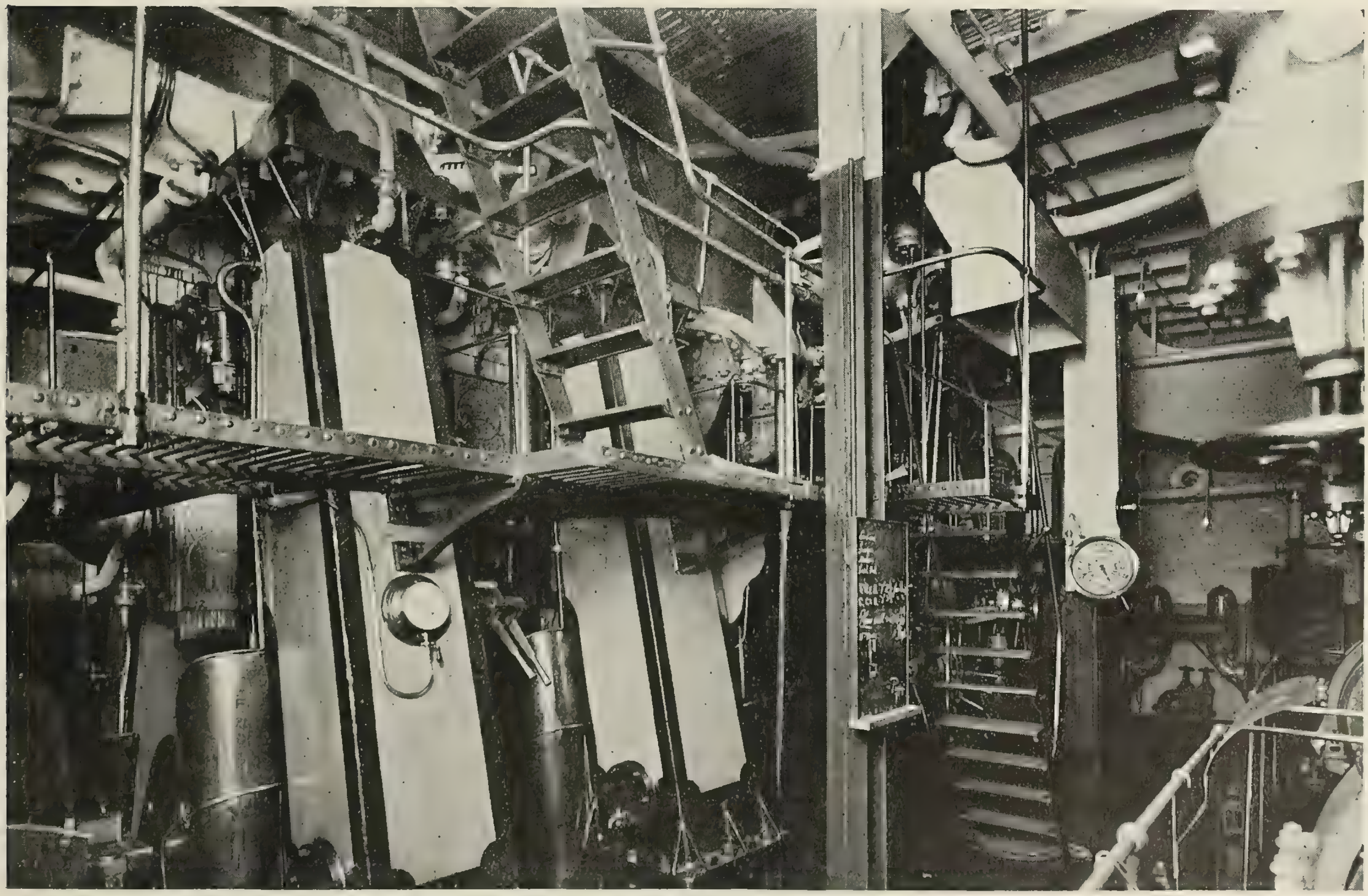
Each deck has been provided with its own public lavatories and bath rooms for men and women.

The promenade deck, with its spacious forward end and wide promenade spaces at the sides, contains forty-two two-berth cabins. On this deck are situated the first class smoking room and observation room. The latter, commanding views ahead and on either bow, is framed in Honduras mahogany. The framing in way of the alcove at the after end is relieved with buttoned mirrors. The pipe trunk in the center of the room also contains a buttoned mirror. The upper portions of the swing doors are of bevelled glass, protected with a brass grill. The floor is carpeted and in front of the cane chairs are upholstered footstools.

The smoking room, at the after end of the vessel, is an exceedingly handsome room, framed in black walnut, with large plate glass windows and a barrel roof overhead with a central light framed in leaded glass, embodying the dog-



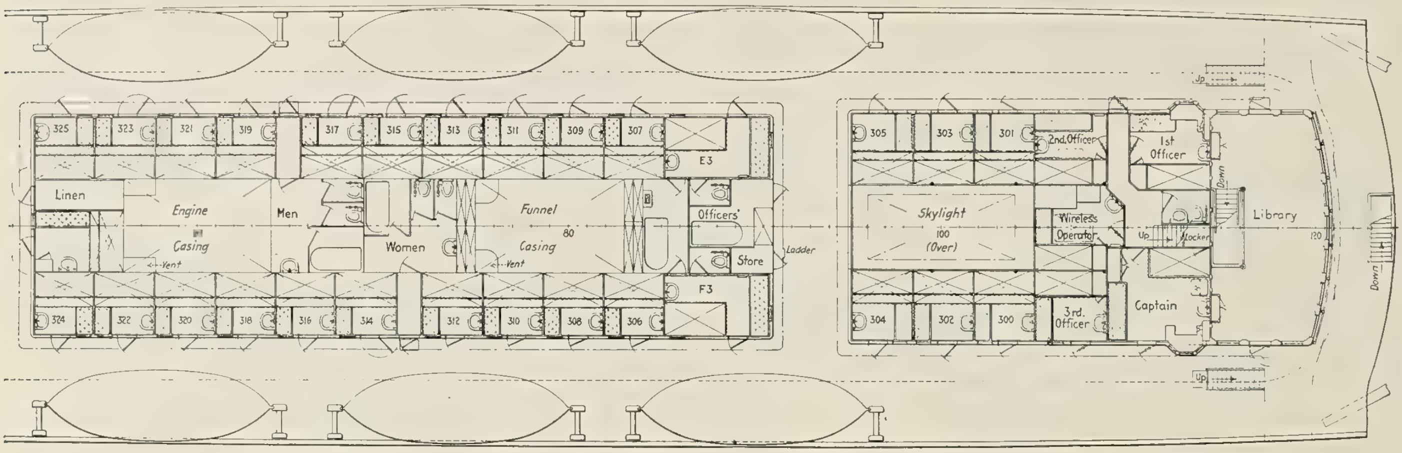
Engine Room, Port Side, Showing Condenser and Auxiliaries



Engine Room of Princess Louise, Starboard Side, Looking Forward

wood as a floral motive. The after and forward ends of this roof also have leaded lights, having as their decorative scheme a representation of the "Siwash Rock" and the "Lions," two well-known local scenic features. The floor is covered with linotile, as are also all passageways on this deck. The forward well is beautifully framed with a white enamel finish. The skylight above has a representation of panels on their upper portions. Leading from the main entrance forward are the barber's shop and baggage room. The waiters and executive officers are berthed forward of the main entrance on this deck.

Aft of the main entrance is the social hall, containing the purser's office and main staircase, with a mirror at the top. The floor is laid with a wood deck and the pillaring has



Arrangement of Accommodations on Boat Deck

the arms of individual Canadian provinces in each of its ten panels. In the after skylight the panels have motives representing British Columbia industries.

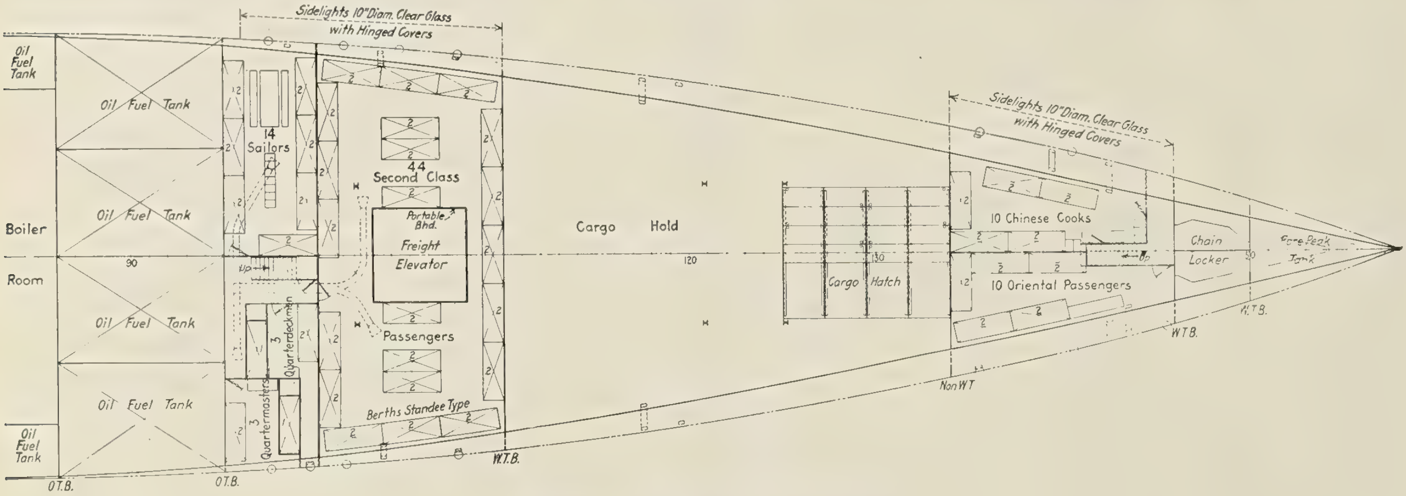
All the balustrades are of wrought iron, with small gilded rosettes in the center for decorative effect.

There are two stairways leading to the awning deck, which is the main passenger deck, containing altogether sixty cabins, twenty-two of which have a sofa berth in addition to the two Pullman berths.

On this deck are also four suites de luxe, each with an individual toilet, and a bathroom common to two. Between been so arranged as to give space for dancing. All around the sides are upholstered arm seats.

All of this deck, aft of the forward social hall is laid with linotile of varying designs. Aft is the stairway to the dining saloon, located on the main deck below surrounded with wrought iron balustrades while on either side are the writing rooms and sitting rooms, respectively, each framed in mahogany.

The main deck forward contains the firemen's quarters, mail room, freight space with its large ports and freight elevator. Amidships are the engineers' quarters, second class



Forward Orlop Deck Arrangement

each suite there is an alcove containing a folding berth with swinging doors, such that the alcove can be made part of the room or a passage between the suites. One suite is framed in bird's-eye maple and its neighbor in satin walnut. On the opposite side of the vessel the two suites are finished in tapestry panels with handsome stucco floral moldings. Each suite has a double brass bedstead, dressing table and wash basin with mirror set in the panelling.

Forward on this deck is the main entrance, beautifully framed in walnut with the floor covered with linotile of tasteful design. The fairweather doors have small glass smoking and dining saloon, crew's mess, bakery and butchery and cold storage rooms. Aft are the galley and dining saloon. The galley is very completely equipped and is entered from the dining saloon by two leather covered swing doors.

The dining saloon, with tables to seat one hundred and forty is framed in natural oak, with a shelf at the sides. At the after end is the sideboard with mirror and cabinets, with leaded glass doors. At the forward end is a handsome screen, with its swinging doors shutting off the staircase. The upper half of this screen is framed in leaded glass.

Underneath the staircase is the silver locker with a very complete layout of drawers and shelves. The side ports are 16 inches in diameter and are arranged in couples. The floor is laid with black and white linotile squares.

The orlop deck, in addition to freight spaces, contains the second class accommodations and crew's quarters.

One very noticeable feature in connection with the comfort of the travelling public is the fact that a hot and cold water system has been installed throughout the vessel, each cabin having a basin with a hot and cold supply. The baths have also a cold salt supply.

In connection with safety appliances it may be mentioned that the boats are swung on Steward davits, this being the first Canadian Pacific Railway vessel to be so equipped.

Propelling Machinery

The propelling machinery consists of one set of four cylinder triple expansion engines, balanced on the Yarrow-Schlick-Tweedy system, designed to develop 4,500 indicated horsepower, at full speed. The cylinders are 28, 43, 50 and 50 inches diameter with a common stroke of 39 inches.

The cylinders are all separate castings and are fitted with liners, the spaces between the liners and the bodies being utilized as steam jackets. The bedplate is cast in two sections and bolted together at about the middle of the engine.

The crank shaft is built up in two sections, one section carrying the forward low pressure and high pressure cranks, and the other the intermediate pressure and after low pressure cranks, the two sections being connected by solid flanged couplings.

The propeller is built up, having manganese bronze blades and a cast steel boss.

Steam is supplied at 180 pounds per square inch by four Scotch marine boilers, each 16 feet in diameter by 12 feet long and having 3,340 square feet of heating surface. The boilers are operated under a closed stokehold system, air being supplied by two engine driven fans.

Oil fuel is used, a pair of horizontal duplex pumps drawing the oil from the bunkers, through suction strainers, and discharging through a battery of heaters and discharge strainers to the furnaces. The furnaces have a ring of fire brick inside the fronts and a hanging arch at the back end. The combustion chambers are also fitted with a checkerwork brick wall.

Auxiliaries

The condenser has a cylindrical steel shell made of one piece of plate with the end bars welded on and with the longitudinal seam electrically welded. The tubes are of Admiralty mixture and are packed at both ends with corset lacing secured by shoulder ferrules.

Cooling water is circulated through the condenser by an independent centrifugal pump driven by an open engine.

To draw the condensation and air from the condenser a Dual air pump is provided, fitted with a cold water circulating arrangement to reduce the density of the vapor.

A pair of vertical simplex pumps take the feed water and discharge it through the filter and feed water heater to the boilers. The feed water heater is of the surface type and is supplied with exhaust steam at 5 pounds pressure. Each feed pump is large enough to supply the boilers when running at full power.

Other auxiliaries include the general service, ash ejector, ballast and cold and hot fresh water pumps. The latter circulates hot fresh water to all wash basins in the vessel.

The electric generating plant consists of two 63 kilowatt 110 volt dynamos, each driven by an enclosed forced lubrication compound engine.

A small CO_2 refrigerating plant is located in the shaft tunnel.

Steam and exhaust piping in the machinery space is in general of solid drawn copper. The main and auxiliary steam pipes from each boiler are extra strong lap welded steel pipe with the pipe expanded into forged steel flanges. All steam and exhaust piping is covered with efficient insulation. The bilge and ballast piping is cast iron with lead bends, except in the stokehold where the bends are extra strong lap welded steel, the extra strong pipe being provided to compensate for corrosion.

Oil fuel piping is lap welded steel with pressed steel flanges. At all distribution points in the piping manifolds are provided.

The boilers were built by the Vulcan Iron Works, Ltd., of Vancouver, while the main engines and practically everything in the engine room, except the auxiliary machinery, were built in the yard's own shops.

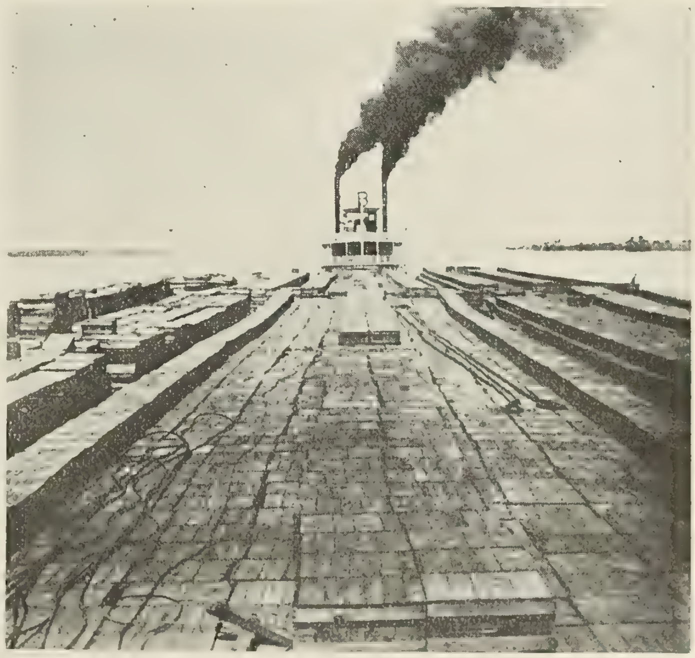
Trials

During the trials the machinery ran exceptionally well. Opportunity was taken during the run from Vancouver to Esquimalt Dry Dock to get everything worked in. The care taken during construction was amply repaid on the trials as there was no sign of heating at any of the bearings.

The balance was also all that could be desired as at the highest rates of revolution the slight athwartship rocking, which is charactereistic of this type of engine, was not apparent.

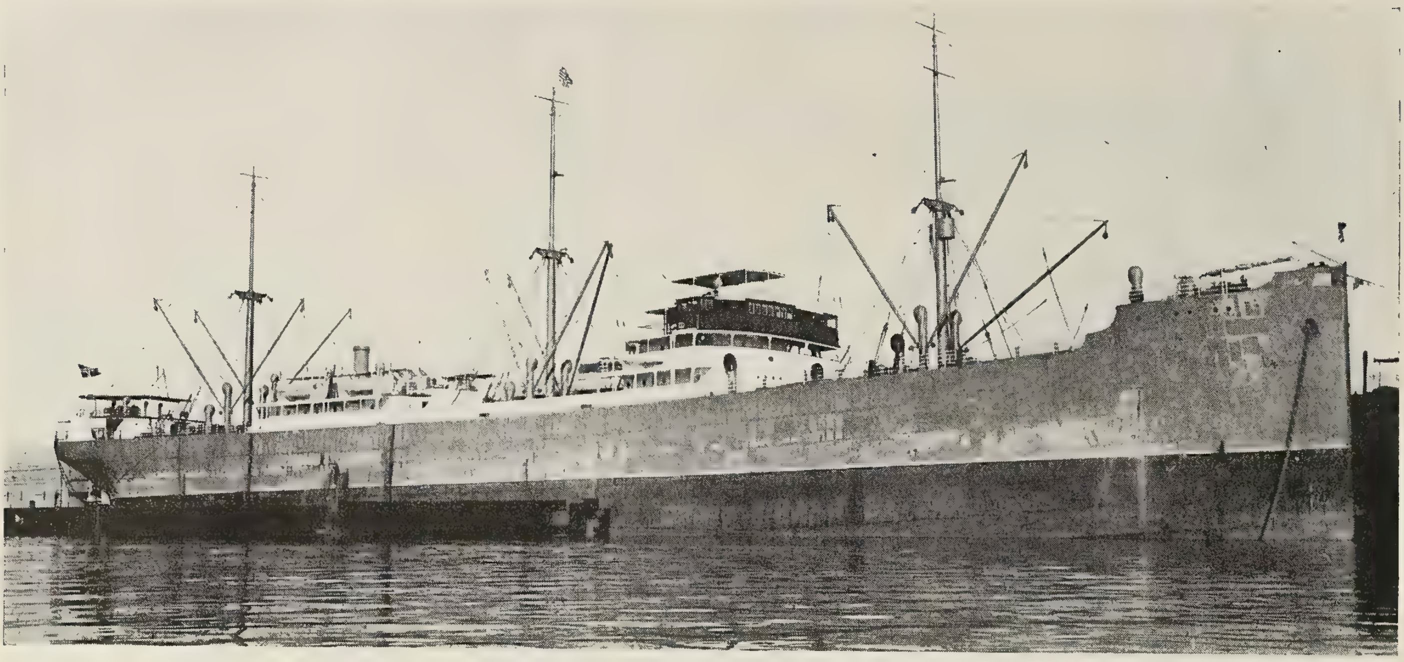
The trials consisted of an endurance run of about four hours' duration at the rate of revolution required to give the contract speed of 16 knots. This was carried out without trouble and steam was easily maintained. The progressive trial was a series of runs, in pairs, over the Parry Bay measured mile. Commencing at 12 knots the speed was increased in steps of about 1 knot until a maximum of 17.48 knots was obtained.

So far as the builders are aware the main engines for the *Princess Louise* are the largest marine engines, and also the first balanced, four cylinder triple expansion engines, which have been built in Canada.



Mississippi River Steamer Handling a 5,000-Ton Tow

The illustration shows the Mississippi River steamer *Mamie S. Barrett*, of the Barrett Towboat Company, Cairo, Ill., towing six barges loaded with approximately 5,000 tons of cargo from the head of the Ohio River to New Orleans, La. The *Mamie S. Barrett* is propelled by a pair of compound engines built by the Charles Barnes Company, Cincinnati, O. The diameter of the high pressure cylinders of these engines is only 10 inches and the fuel consumption is approximately 2½ tons of bituminous coal in 24 hours. Considering the power of the vessel and its small consumption of fuel the volume of tonnage handled is remarkable.



Motorship Handicap Loading Case Oil at Port Arthur, Tex., for China

9,000-Ton Deadweight Norwegian Motorship Handicap

Description of Novel Features and an Analysis Showing the Advantages of the Motorship Over the Steamer

By Edward B. Pollister

On May 15, 1922, the motorship *Handicap* arrived at Port Arthur, Texas, in ballast from Hamburg, and loaded a full cargo of Texas Company case oil for China. The installation of Sulzer two cycle Diesel marine engines was inspected by several marine engineers and representatives of eastern shipowners and shipbuilders, who were interested in the many novel features presented for the first time in the adaptation of the Diesel engine to cargo ship propulsion.

In the latitude of Port Arthur, Texas, the engine room of the *Handicap* with its highest recorded temperature in the tropics of 108 degrees Fahrenheit, was found to be cooler than on deck.

Captain Gustav Sundaa and Chief Engineer Holms extended every courtesy to the visitors.

The *Handicap,* the largest vessel (steam or motor) ever built in Norway, has fine lines and an attractive appearance. Including bunker fuel, she has a deadweight capacity of 9,000 tons on summer freeboard. The ship was constructed by Rosenberg Mekaniske Verksted, at Stavanger, for Messrs. Bruusgaard Krosterud and Company, of Drammen, to the highest class in Norske Veritas (the Norwegian Register) and according to the rules and regulations of the Norwegian Board of Control.

The *Handicap* completed her trials December 14, 1921, and left Stavanger on December 24, for Newport, there loading 7,760 tons of coal for Bahia Blanca. No trouble was experienced with the propelling machinery and on arrival at Bahia Blanca she maneuvered under her own power and did not require the help of a tug.

Performance on Maiden Voyage

Stavanger to Newport	980 miles
Newport to Bahia Blanca	6,390 miles
Mean speed of ship	10¾ knots
Total daily fuel consumption	9.4 tons
Total daily lubricating oil consumption	24.3 gallons
Return voyage—Bahia Blanca—Hamburg	6,943 miles
Mean speed	10 knots
Total daily fuel consumption	10.2 tons
Total daily lubricating oil consumption	22.2 gallons

The *Handicap* sailed from Bahia Blanca with a full cargo of grain, encountering strong winds and heavy seas throughout the whole voyage to Hamburg. Heavy storms were encountered on April 3 and 4, which reduced the speed of the ship at times to 8¾ knots.

The fuel consumption includes not only the fuel used for the main engines, but also that necessary for the auxiliary engines supplying current to the motors for the turbo blowers for lighting, heating, cooking, steering gear and auxiliary machinery.

Dimensions and General Particulars

Length, between perpendiculars	415 feet
Beam, molded	54 feet 6 inches
Depth, molded to shelter deck	36 feet 11 inches
Deadweight capacity, about	9,000 tons
Gross tonnage, about	5,200 tons
Speed, fully loaded	11 knots
Fuel consumption, per day	9.3 to 9.5 tons
Main engines, twin screw	2,700 shaft horsepower
Type	Sulzer, 2 cycle, controlled port scavenging
Number of cylinders per engine	4
Cylinder bore	600 millimeters (23⅝ inches)
Piston stroke	1,060 millimeters (41¾ inches)
Speed	100 revolutions per minute
Auxiliary engines	two, each of 330 brake horsepower
Type	Sulzer, 2 cycle
Speed	210 revolutions per minute
Total weight of main engines, including thrust bearings, flywheels, turbo-blowers, with motors, exhaust silencers, starting and injection air tanks, about	752,400 pounds

Captain Sundaa (center) on the Bridge of the Handicap

Deck View of Motorship Handicap, Looking Aft

Weight per brake horsepower of main engines..........278 pounds
Total weight of auxiliary engines, without electric generators, but with flywheels, silencers and air tanks ....136,400 pounds
Weight per brake horsepower of main engines........50.5 pounds
Total weight of main and auxiliary engines, per brake horsepower of main engines.......................328.5 pounds

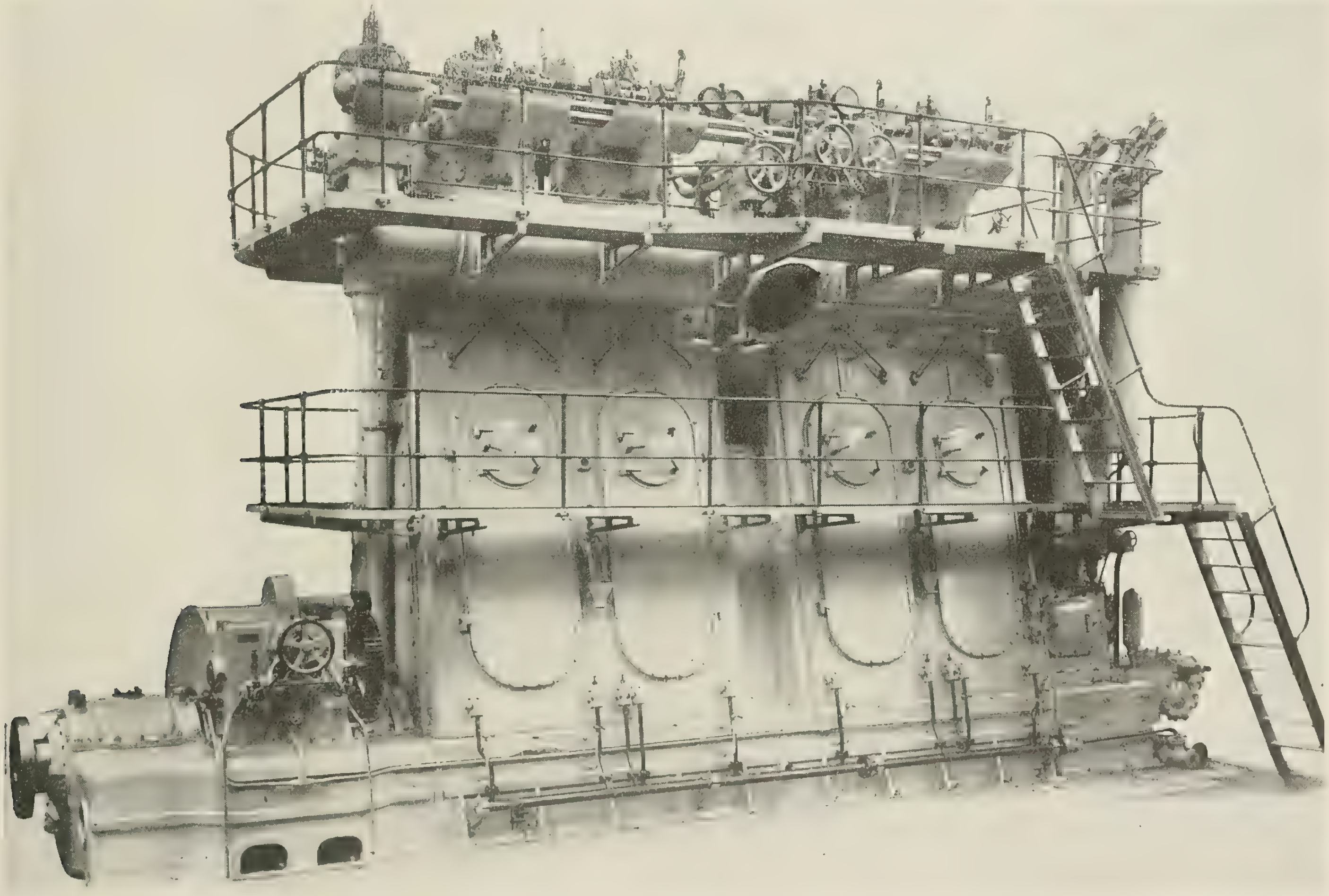
Main Engines

The main engines have four working cylinders, 23⅝ inches diameter and 41¾ inches stroke, with the injection air compressor built integral with the engine. Air for scavenging is furnished by electrically driven turbo-blowers. The visitor is at once impressed with the short length of the engine room (about 40 feet) which this arrangement makes possible. The maneuvering station is located at the upper engine platform, Chief Engineer Holms being strongly in favor of this arrangement, which gives the operating engineer an unobstructed view, at the cylinder head level, of the entire engine room, including valve gear and switchboard. An assistant on the lower grating handles the auxiliaries.

The engines are capable of being operated continuously at maneuvering speeds as low as 25 revolutions per minute and require a comparatively small quantity of injection air under such conditions due to the Sulzer control of lift and duration of opening of the fuel valves.

The Sulzer thrust block, built as an extension to the main bedplate, is similar in principle to the *Kingsbury* type. It is lubricated from the lubrication system on the main engine and showed practically no wear.

The general design of the engines is similar in all important features to the Busch-Sulzer marine Diesel, built by Busch-Sulzer Bros.-Diesel Engine Company, St. Louis,



Sulzer, Two-Cycle, Marine Diesel Engine Designed to Develop 1,350 Brake Horsepower at 100 Revolutions per Minute With Independently Driven Scavenging Pump

Mo., which enjoys partnership affiliation with Sulzer Bros., of Winterthur, Switzerland, and which owns all United States rights and patents for the manufacture and sale of Sulzer engines in this country. Space will, therefore, not be taken here for a technical description of the main engines.

Turbo-Scavenging

Although Sulzers have furnished numerous large submarine installations in which the scavenging air for the engines is supplied by electrically driven turbo-blowers, instead of by scavenging pumps built integral with and driven by the main engines, the *Handicap* is the first commercial vessel so equipped. There are two blower sets, each of capacity for both main engines, one acting as spare. The two sets are located on the level of the control station at the forward engine room bulkhead, one on the starboard and one on the port side, in compartments closed off from the main engine room by doors, the motor blower set requiring about 7 feet by 8 feet floor space. They occupy no part of the engine room which would be otherwise utilized, and the air piping is carried beneath the gratings to the engines in such a manner as to avoid obstructing any passages and yet to be readily accessible from below. The air may be taken from the deck above, or from the engine room floor level to assist ventilation in hot climates. This results in a remarkably cool engine room, the main floor level not exceeding 86 degrees Fahrenheit when passing the equator, although the temperature at the control station was about 108 degrees Fahrenheit.

The blowers are operated at 2,800 to 3,400 revolutions per minute, by 220 volt, direct current motors, without vibration or excessive noise. It has never been necessary to shut down a blower due to faulty operation, and absolutely no trouble has been experienced with these sets. The commutators on the motors were smooth, and an entire absence of sparking at the brushes was noticeable. The power required for the blowers is about 4 percent of the power of the main engines during normal operation.

No Steam Used

On the *Handicap* the use of steam is entirely eliminated. The cabins are heated by electric radiators and the galley is fitted with electric range, electric boilers and an exhaust-gas oven.

The exhaust gases from the engines, at a temperature of about 700 degrees Fahrenheit, are led around an oven which affords a baking heat of 300 degrees to 500 degrees Fahrenheit, attained without additional fuel cost and sufficient to bake the bread for a crew of 35, when the main engines are running. In port, the oven of the electric range is used.

Auxiliary Diesels

The auxiliary Diesels are larger than are usually found on motorships of this size, but are more efficiently employed. The number of auxiliary units has been reduced to the minimum of two—each capable of handling maximum requirements, and consisting of a four cylinder, 330 brake horsepower Sulzer two-cycle crosshead type Diesel, coupled to 200 kilowatt, 220-volt generators, operating at 210 revolutions per minute. The length of the engine is about 13 feet.

At sea, one of these units supplies electric power for the turbo-blower set (about 110 brake horsepower), the engine room pumps, auxiliaries, and steering engine, and current for lighting and heating the cabins and for cooking. The total load at sea averages about 200 brake horsepower.

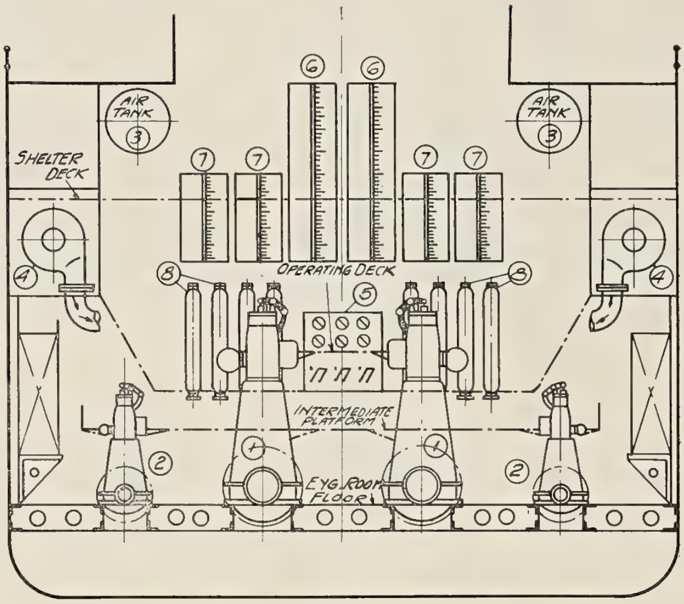
In port, one unit takes care of the maximum requirements of 10 electric winches of the Asea type, built in Sweden, and the lighting, heating, cooking and small engine room auxiliaries.

This arrangement accordingly results in the auxiliary Diesel capacity, required for winches in port, being largely employed at sea in driving the turbo-blower supplying scavenging air to the main engines, which may therefore be built smaller and shorter. The total weight of the equipment is reduced and the load factor on the total brake horsepower of main and auxiliary engines is increased.

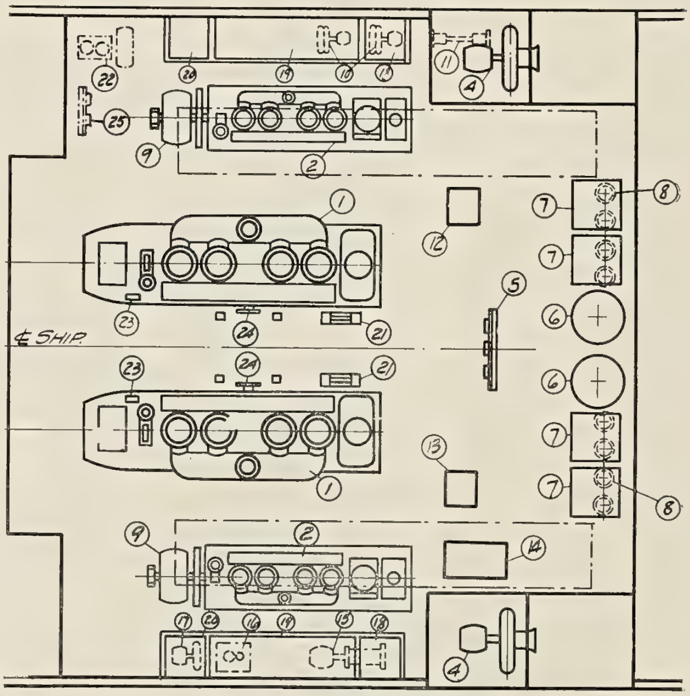
A hot bulb emergency lighting and compressor set provides 15 kilowatts capacity for port lighting, when the winches are not in use.

Elimination of Auxiliary Air Compressors

The air compressors of the two auxiliary Diesels are oversize; their combined excess capacity is sufficient for driving



Section Through Engine Room, Looking Forward



Plan of Engine Room

1—Main engines
2—Auxiliary engines
3—Low pressure air tanks
4—Turbo blowers, motor driven
4A—Suction chamber to turbo blower
5—Switchboard
6—Fuel service tank
7—Lubricating oil tanks
8—Starting air tanks
9—Auxiliary engine generator
10—Cooling pumps
11—Fuel service pump
12—Fuel transfer pump
13—Bilge pump
14—Ballast pump
15—Fire pump
16—Ice machine
17—Fresh water pump
18—Fuel service tanks for auxiliary engines
19—Reserve lubricating oil tanks
20—Reserve lubricating oil tanks
21—Lubricating oil pump
22—Emergency lighting set (8-kilowatt)
23—Barring engine
24—Reversing engine
25—Switchboard for emergency set

one main engine, which provides the required reserve compressor capacity for emergencies. This saves the installation of the usual motor driven auxiliary compressor of about 150 brake horsepower for this size of vessel.

The surplus air is used for charging the starting and maneuvering air tanks of which there are eight, each having a capacity of 28 cubic feet at 60 atmospheres.

Air at any pressure from 60 to 20 atmospheres (850 to 285 pounds per square inch) is utilized for starting and maneuvering, the high pressure storage providing ample reserve capacity for extensive maneuvering on entering port.

A large supply of low pressure air, 200 pounds per square inch, is carried in separate tanks for the operation of the maneuvering motors on the main engines, the turning engines, the siren and for minor purposes, including small auxiliary lubricating pumps used before starting up.

Captain Sundaa, who "went down to the sea" as a cabin boy on a windjammer at the age of fourteen, accepts the motorship in the same spirit that he was forced to accept the steamer, years ago—one of reluctance, tempered with a desire to be first with a new type of vessel which was bound, in his opinion, to replace the old.

Telling the story as nearly as possible in the captain's words: "The engines run quietly, without sufficient vibration to tell, from his cabin, whether they were running or shut down. Cylinder heads were being removed for the first time in five months, to meet provisions of semi-annual inspection required by the Norwegian Board of Control. Aside from minor grinding of valves and adjustments, no repairs had been necessary, the cylinders and combustion chamber parts were clean and the wear of rubbing surfaces extremely small."

So far the ship had given a good account of herself, the only stoppage at sea having been due to air pockets in the fuel line, on a voyage to South America, and a safety gasket blowing out on the trip from Hamburg to Port Arthur.

Important Advantages of the Motorship Over Steam in Addition to the Fuel Saving

The fuel consumption of the *Handicap* is only 9.3 to 9.5 tons a day, for 11 knots, as against 30 tons for a steamer. Only 3 men, namely a motorman, a junior motorman and an oiler, are required on a watch in the engine room, two electricians, two wiper boys and a mechanic bringing the engine room crew up to 14.

But other advantages of the motorship over the steamer are of far-reaching importance and not always given due consideration.

The investment in a ship over a twenty-year period is safeguarded more securely by low cost of operation which prevents losses in bad times, than by expectation of big profits in good times.

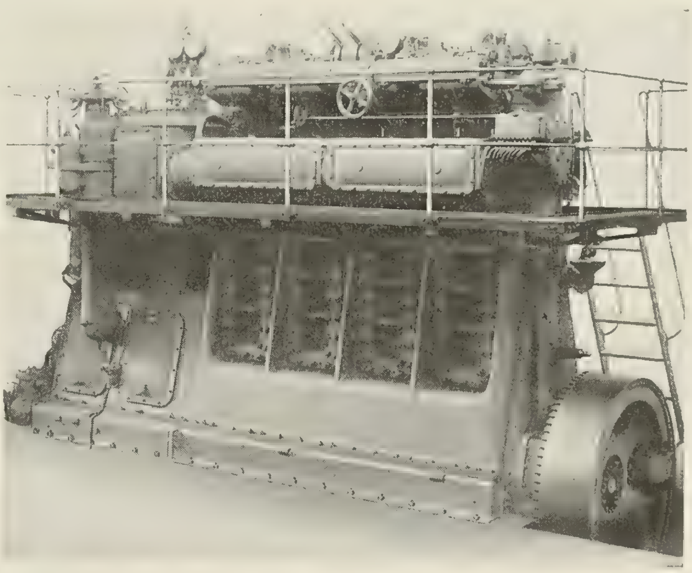
The motorship will average more days at sea, which is the only time a vessel earns money. With approximately 1/3 of the fuel consumption of a steamer, less time is lost in fueling enroute, or in deviating for fuel with additional cost of port charges. More freight can be carried, at rates below the cost of operating a steamer, if necessary for quick return freight. Long voyages can be undertaken to ports where fuel is scarce or high, bunkered with fuel sufficient for the complete turn-about and bought where it is cheapest. The motorship also can, with profit, collect small scattered freight which would be unprofitable for a steamer. The steamship must also secure more freight to pay the higher operating expenses of a return voyage, and this waiting in port cuts down the number of days per annum she will be at sea with profitable freights. While in port, the standby losses of the steamer are, comparatively, very high and, where lack of up-to-date dock freight handling apparatus causes delays of several days, the cost of handling cargo at 6 tons of fuel per day for the steamer as against 0.6 ton for the motorship becomes an important item.

These advantages are illustrated by the present voyage of the *Handicap*.

A full cargo of case oil was offered for China, from Port Arthur, Texas, each case stowing 2.2 cubic feet, weighing 84 pounds, 26.7 cases to the ton, freight rate about $9.00 per ton.

For the outward voyage (about 10,000 miles)—39 days at sea, 11 knots, 9.5 tons per day—370 tons of fuel will be burned, and, with 25 percent reserve, 465 tons carried—without refueling enroute.

With a deadweight capacity of 9,000 tons, including fuel, the maximum cargo which could be loaded at Port Arthur was 8,535 tons, or 228,000 cases. A corresponding steamer must allow bunker capacity for the longest leg—Honolulu to



Sulzer Two Cycle Auxiliary Diesel Engine. Develops 330 Brake Horsepower at 210 Revolutions per Minute

Hongkong, 4,900 miles—19 days at 11 knots, 30 tons of fuel per day, 570 tons burned; plus reserve of 25 percent requires a minimum bunker capacity of 715 tons; thus the maximum cargo which could be loaded at Port Arthur would be 8,285 tons, or 221,000 cases.

Difference in Favor of Motorship

1—Additional freight, 250 tons @ $9.00			$2,250.00
2—Steamer must deviate from Canal to Honolulu additional mileage—1 day's run—fuel @ 30 tons per day @ $7.80			234.00
3—Port charges—Honolulu, including towing and pilotage			250.00
4—One day additional operation of ship, exclusive of fuel			150.00
5—Outward voyage:			
Fuel burned by motorship, Port Arthur fuel, 370 tons @ $9.80		$3,615.00	
Fuel burned by steamer:			
Port Arthur fuel 600 tons @ $7.80	$4,680.00		
Honolulu, fuel 570 tons @ $9.25	5,275.00	9,955.00	6,340.00
6—Return voyage:			
Fuel burned by motorship, Hongkong fuel, 370 tons @ $17.60		$6,500.00	
Fuel burned by steamer:			
Hongkong fuel, 570 tons @ $15.60	$8,850.00		
Honolulu fuel, 600 tons @ $9.25	5,550.00	14,400.00	7,900.00
Port charges—fueling at Honolulu			250.00
1 day additional sailing—30 tons fuel @ $9.25			275.00
1 day additional operating expenses exclusive of fuel			150.00

7—Loading and discharging cargo—20 days fuel:		
Motorship—Port Arthur 10 days @ 0.6 ton @ $9.80	$59.00	
Hongkong 10 days @ 0.6 ton @ $17.60	105.00	
	$164.00	
Steamer—Port Arthur 10 days @ 6 tons @ $7.80	$468.00	
Hongkong 10 days @ 6 tons @ $15.60	936.00	
	$1,404.00	1,240.00
Total excess cost of operation of steamer		$19,039.00

Earnings of the Steamer

Earnings of the steamer—8,285 tons @ $9.00		$74,565
Round trip, returning in ballast 100 days		
Estimate:		
Operating expense, except fuel @ say $150.00 day	$15,000	
Panama tolls @ 2 x $6,000	12,000	
Fuel	26,268	
2 calls Honolulu, port charges	500	53,768
100 days steamer's gross earnings		$20,797

Earnings of the Motorship

Earnings of the motorship—8,535 tons @ $9.00		$76,815
Round trip, returning in ballast 98 days		
Estimate:		
Operating expense, except fuel at $150.00 day	$14,700	
Panama Canal tolls @ 2 x $6,000	12,000	
Fuel	10,272	36,972
98 days motorship gross earnings		$39,843
365 days motorship		$147,000
365 days steamer		76,000
Additional gross earnings of the motorship		$71,000

Ratio of Earning Capacity—Motorship to Steamer—Is 1.93 to 1

In the above figures a differential of $2.00 per ton has been assumed for Diesel fuel above the price of boiler fuel —which is applicable to all motorships and fair to the 2-cycle, until the claims of the 2-cycle marine Diesel builders, that operation of their engines on boiler fuel is entirely satisfactory have been more definitely established.

Advantages of the greater sailing radius of the motorship and increased earnings due to purchase of fuel in that port where it is cheapest have not been taken into consideration.

It is reasonable to assume that the reduction in the payroll of the engine room crew will more than offset the increased cost of lubrication for the Diesel.

That the rate of depreciation of the steamer is greater than the motorship is shown by the present market price of going steamers, which is less than one half their book value; while practically no going motorships are offered.

The above figures assume steady trade and no idle time, which, of course, would not be the case. If it were, the motorship could cut freight rates sufficiently to wipe out the profits of the steamer and still show gross earnings of $71,000.00 per annum.

As a matter of fact, the $76,815.00 freight money earned by the *Handicap* on her China voyage must pay her expenses from Hamburg in ballast to Port Arthur—Port Arthur to China, and from time of discharge of cargo at Hongkong until she secures another cargo. So that the actual earnings for the year will not be as shown.

That the actual saving is greater than that usually estimated is shown by the growth of motorship fleets—the aggregate of all of the economies and advantages of motorships being best known by their owners.

While a tramp run to the Orient is especially favorable to the motorship, other runs such as Pacific Coast to United Kingdom ports—a turnaround of 25,000 miles, offer almost equally favorable conditions for freight liners.

A steamer, loading deadweight cargo on the Pacific Coast, must hold in reserve sufficient bunker capacity for fuel from the Canal to the United Kingdom, a run of about twenty days. With the differential of 20 tons per day for the above ships, plus 25 percent reserve, 500 tons more cargo could be carried by the motorship at say $12.00 per ton or $6,000.00. On arrival in England, fuel must be purchased at say 60 shillings ($13.50) per ton for port use, and the return voyage to New York—approximately three times as much fuel must be purchased at this comparatively high price, for the steamer as for the motorship.

Considering the progress the motorship is making in the world's merchant marine, the probable obsolescent decline during the next few years in the value of a steamer reduces the comparative fixed charges on the motorship by between 5 and 10 percent and offsets to a degree the added cost of converting existing steam tonnage.

This would be shown by the above figures on earnings, somewhat as follows:

	Motorship	Steamer
Tonnage, deadweight	9,000	9,000
Gross earnings	$147,000.00	$76,000.00
Fixed charges	15 percent	20 percent
(Allowing 5 percent greater depreciation in value of steamer)		
Investment basis, total	$980,000.00	$380,000.00
Investment basis, per ton	$108.80	$42.20
Present sales value going steamer per deadweight ton world's market		$35.00
Corresponding value of motorship on above investment basis	$90.00	

The United States Shipping Board is offering steamships for conversion to Diesel propulsion at prices which will bring the cost of the motorship to about $75.00 per deadweight ton, a price which shipowners would be fully justified in paying, considering the above comparative earnings.

Argentine Naval Training Ship Presidente Samiento Anchored in North River, New York

Japanese Channel Steamer Keifuku-Maru on Trial

Twin-Screw Turbine Channel Steamer Keifuku-Maru

First of Three 17¼-Knot Passenger Vessels for Shimonoseki-Fusan Service of Japanese Government Railway Completed at Kobe

THE cross-channel service between Shimonoseki and Fusan in Japan is at present run by the Japanese Government Railway with a fleet of four steamers, the *Koma-Maru, Shiragi-Maru, Iki-Maru* and *Tsushima-Maru,* performing the journey in more than eleven hours. Owing to the recent increase of traffic on this route, it was decided in 1920 by the Railway Department to reinforce the existing fleet with three larger and faster steamers of the latest improved type.

The order for these new ships was placed with the Kobe Works, Mitsubishi Zosen Kaisha, Ltd., Kobe, Japan. The first of the three steamers has recently been completed and delivered to the owners. In their arrangement and equipment, every attention has been paid to the special requirements of this service, and in this respect mention must be made of the work of Mr. T. Morisawa, the marine superintendent to the Government Railway, and his staff, under whose supervision on behalf of the Railway Department the vessel has been completed, while the design of both hull and machinery was entirely entrusted to the builders to fulfill the requirements of the owners.

The leading particulars of the *Keifuku-Maru* follow:

Length overall	375 feet 0 inches
Breadth, molded	46 feet 0 inches
Depth, molded to awning deck	28 feet 0 inches
Gross tonnage	3,620
Draft loaded	15 feet 0 inches
Deadweight capacity, in tons	600
Number of passengers:	
First class	45
Second class	214
Third class	690
Total number of passengers	949

Palm Room Cafe

Smoking Room

Number of officers and crew	159
Total number of passengers and crew	1,108
Highest speed on trial	20¼ knots
Speed on service	17¼ knots

The *Keifuku-Maru* has been built, engined and equipped in accordance with the Japanese Government Shipbuilding and Inspection Rules under their special inspection as an awning deck vessel of coasting service.

General Arrangement

As shown by the illustrations, the vessel has a short forecastle with a raked stem, cruiser stern, two masts and two funnels.

The double bottom, built on the cellular principle, extends between the peak bulkheads, except under the boiler space. The vessel is subdivided by six transverse watertight bulkheads, all extending to the main deck except the collision bulkhead which is carried up to the awning deck.

Special Sitting Room

There are two complete tiers of decks, viz., the awning and the main, and a promenade deck over the long deck house amidships, a lower deck and a flying bridge deck.

The promenade deck is mainly allotted for the promenade of the first and second class passengers. On this deck forward are the captain's and the officers' cabins and toilets and the special suite of rooms, consisting of a sitting room, bedroom and private bathroom, and a first class stateroom.

The smoking room and palm café are also situated on this deck between two funnels.

Ten lifeboats and one sampan are carried on this deck aft.

The awning deck is almost entirely occupied by the passenger accommodations, the first class staterooms being amidships, the second class sleeping rooms and open space aft. The restaurant and the reception and writing rooms are also on this deck forward of the first class accommodations, and the sailors' quarters are under the forecastle.

On the main deck are part of the third class passenger accommodations and accommodations for the engineers, clerks, doctors, custom officers, etc., the officers' and engineers' messrooms, galleys, sculleries, pantry and stores. There is also a large mail room on this deck forward.

The lower deck abaft the engine space is arranged for the remaining third class passenger accommodations and the baggage room, steering engine space and carpenter's store.

The firemen's and the boys' quarters are located on the lower deck forward of the boiler space, the space below being devoted to a cargo hold. In the forehold are a fish hold, provision stores and the chain lockers.

Passenger Accommodations

Excellent results have been achieved in fitting out the passenger accommodations on the *Keifuku-Maru,* and particular attention has been paid to ensure the comfort and pleasure of passengers consistent with the requirements of a short passage.

The public rooms include a smoking room, palm café, restaurant, and reception and writing room, all of which are tastefully decorated and furnished.

The smoking room is finished in stained oak in the Elizabethan style. A large wagon top skylight with attractively designed stained glass and large square windows admits air and light. A bar with counter is provided at the forward end of the room. The floor is laid with rubber tiling of special design well matched to the room.

A special feature of the palm café, adjacent to the after end of the smoking room, is the striking originality of its design, giving passengers the impression of sitting in a greenhouse on shore. The specially designed windows of exceptional size and a large stained glass skylight aid materially in lighting and ventilating the room. The walls are finished in green trellis work on braided rattan ground over marble skirting, and four artistic oval cloisonné plaques and a large oval mirror are attractively arranged. The floor is covered with rubber tiling of chess-board pattern in dark green and white.

At the after end of the palm café, there is a grand stairway leading to the main entrance on the deck below, which is finished with handsome balusters and hard wood rails. At the head of this stairway is mounted a large oil painting depicting "A country scene of Chosen (Korea)" by Mr. H. Kanayama.

A spacious and airy restaurant, situated at the forward end of the awning deck house, is framed in Nara (a kind of oak) with silk panels over dado of polished Nara. The ceiling is panelled and painted in dull white. A stained glass skylight and glass mosaic plaques are fitted overhead.

A number of small tables accommodating parties of four and one larger table for six in front of the bay-windows on each side are arranged. An imitation fireplace at the forward end adds a homelike touch to the appearance of the room. Surmounting the fireplace is an artistic picture of cut-velvet representing the garden scene of the Keifuku palace. The floor is of neatly designed rubber tiling.

The reception and writing room adjacent to the after end of the restaurant is reached through stained glass swinging doors on each side. The room is tastefully finished with extra large panelling painted in light shade in stained oak framing, decorated with a number of carved relieves. The writing tables, seats, tea tables and chairs, all well harmonized to the room, are comfortably arranged. The floor is covered with rubber tiling.

The special suite of rooms previously mentioned is arranged entirely separate from the ordinary first class accommodations. The sitting room is finished in fumed oak with panels of silk damask. The ceiling is plain but tastefully treated, having ornamental fixtures. A picture of silk embroidery representing resting lions is hung on the wall. The special bedroom is furnished with a large bedstead, dressing table, wardrobe and chair, all of which harmonize with the joiner work of the room. The floors of these rooms are covered with thick carpets.

Effective ventilation for the third class accommodations is provided by means of motor fans.

The electric lighting throughout is on an extensive scale, all fixtures fitted in the public rooms having been designed to harmonize with the general scheme of decoration and architecture.

Propelling Machinery

The propelling machinery consists of two sets of Parsons combined impulse and reaction, geared turbines of the modern high speed type. Each set drives one of the twin propellers through a single reduction gearing.

The machinery is designed to develop 8,000 shaft horsepower. Each set consists of two turbines arranged in series, with one high pressure turbine inboard, and one low pressure turbine outboard. The high pressure turbine has one impulse stage and 5 reaction stages of 7 rows each. The low pressure turbine has 11 stages with 22 rows in all. Astern turbines are incorporated in the forward end of the low pressure turbine casings, capable of developing about 60 percent of ahead full power.

A forced lubrication system is provided for all bearings, gearings and shaftings. The main thrust bearings are of the single collar pivoted type.

Boilers

Steam is supplied by 8 cylindrical marine boilers, designed for a working pressure of 200 pounds per square inch and superheat up to 120 degrees F. The boilers are arranged in two groups of four each with two stokeholds. Forced draft is provided by a closed ash-pit system.

The results of the official trial trip were highly satisfactory, extracts of which are shown tabulated as follows:

Result of Official Trial Trip

Date of trial	April 1, 1922
Weather and sea	Fine, calm
Draft, forward	15 feet 2 inches
Draft, aft	15 feet 1¼ inches
Draft, mean	15 feet 1⅝ inches
Corresponding displacement	3,940 tons
Speed (mean of 3 double runs on 3-mile measured course)	19.776 knots
Coal consumption per shaft horsepower per hour	1.3 pounds
Boiler pressure, pounds per square inch	200
Steam pressure:	
High pressure turbine, pounds per square inch	167
Low pressure turbine, pounds per square inch	8
Vacuum, inches	28.5
Revolutions per minute of propellers:	
Port	216.83
Starboard	215.66
Mean	216.25

The electrical equipment of this vessel consists of two 2½ kilowatt Winton generating sets, with large type Edison storage batteries. This equipment will be sufficient to take care of all electrically operated, automatic and auxiliary machinery installed in the boat.

The storage space for supplies will be sufficient to enable the vessel to cruise at great distances from her base of supplies. The cold storage plant consists of an ethyl chloride machine of the Clothel manufacture and several boxes, some in the deck house for daily supplies with others below for cold storage.

John Ringling's Houseboat Zalophus, Just After She Was Launched at the Yards of the Builders

The small boat equipment of the *Zalophus* consists of several fast launches swung on the boat deck to be used by the owner and his party to make trips up small rivers not navigable by the larger boat.

Motor Houseboat Zalophus Launched

JOHN RINGLING'S new steel motor houseboat *Zalophus* was recently launched at the yards of the Consolidated Shipbuilding Corporation, Morris Heights, New York City. The vessel was designed by Henry J. Gielow, naval architect of New York, and is powered with two heavy oil Nelseco engines of 180 horsepower each. The approximate combined weight of these engines is 20 tons. The oil capacity is 6,200 gallons, giving the vessel a cruising radius of over 4,000 miles.

The vessel is 125 feet long overall, 21 feet beam and has a draft of 4 feet, capable of cruising in southern waters during the winter months, and in the north in the summer.

The large deck house on the main deck is approximately 86 feet long. At the forward end a living room is arranged with a stairway down to the owner's suite. The dining room, pantry, servants' lounging and dining rooms and pantry follow. The owner's lounge and smoking room are aft. All sleeping rooms in the owner's quarters, baths and toilet rooms are forward, followed by the engine compartment. The after end is given up entirely to the crew's quarters, which are exceptionally complete, as they include staterooms for the engineers and members of the steward's department, toilet rooms and two shower baths, one for the officers and one for the crew. The captain's quarters are arranged at the after end of the pilot house, with a toilet room and shower bath at the after end.

U. S. Grant Has Successful Sea Trial

THE Army Transport *U. S. Grant,* formerly the *Madawaska,* was given a successful sea trial on Sunday, July 16. The *Grant* left Pier 3, Army Supply Base, Brooklyn, at 9.00 a. m. and proceeded directly to sea, cruising south along the New Jersey coast. At the beginning of the trial, the Filipino firemen, whose previous experience had been confined to Scotch boilers, had some difficulty in learning how to fire watertube boilers.

After they had been shown that the thickness of the fuel on the grates should be from 6 inches to 8 inches rather than from 12 inches to 14 inches, as is desirable on Scotch boilers, and that the back of the grates should be well covered, the steam pressure was raised and the ship made from 14 to 15 knots. It is expected that a speed of 15 knots will be easily maintained when the firemen become accustomed to the boilers.

The principal part of the reconditioning job on the *Grant,* which was done by the Morse Dry Dock & Repair Company, Brooklyn, N. Y., was the removal of three double-ended and one single-ended Scotch boilers and the installation in their place of six Babcock and Wilcox type of watertube boilers. These boilers are fitted for burning coal under forced draft with closed ash pits and open fireroom. Fans are fitted under the back ends of the boilers. Diamond soot blowers of the revolving type are installed on each boiler.

Captain A. B. Fry stated in an interview that "240 tons

of weight had been saved in the boilers and contained water by the installation of the watertube boilers. Savings in weight, the confinement of possible explosions to the blowing of single tubes and rapid steam generation had made watertube boilers very desirable for passenger ships when a supply of good feed water could be obtained."

Captain Fry also said that "after a thorough inspection of the old Scotch boilers on this vessel they had come to the conclusion that it would not be safe to operate them at a pressure in excess of 187 pounds per square inch which, in his opinion, would have been reduced to 165 pounds at the throttle. As the *Grant's* engines are of the four cylinder quadruple expansion type it was thought desirable to install new boilers working at 225 pounds pressure which would insure dry steam, with some superheat effect, at 205 pounds at the high pressure cylinder.

The *U. S. Grant* is admirably designed for tropical service, having high tween-deck heights. Two new 15-ton York refrigerating machines have been fitted to insure efficient service in the hottest weather.

This vessel, which is 490 feet long, 55.3 feet beam, 25.7 feet depth and 9,410 gross tons, sailed for San Francisco on July 20 carrying a general cargo of merchandise, passengers and troops. Her capacity is 126 cabin passengers and 600 troops and she will enter the Army Transport Service between San Francisco and the Orient.

Among those present on the trial were the following: Colonel L. H. Bash, Colonel A. C. Dalton, Colonel Thayer, Major Rice, Captain Robbins, Captain Ferrand, Captain Moore, Captain Bernard and Superintending Engineer J. T. Stewart of the Army Transport Service; Captain A. B. Fry, U.S.N.; Major F. Van Vleck, consulting engineer; Captain Paul Cantry of Motor Transport Service; F. B. Webster, editor of Marine Engineering and Shipping Age; C. H. Want and J. M. Dempsey of the Morse Dry Dock and Repair Company; F. W. Leahy and W. Crawford of the Diamond Power Specialty Company; E. A. Colson and R. D. Bryan of the Babcock and Wilcox Company.

Devices Designed to Cut the Cost of Air Drill Operation

The lubrication of air drills is not generally considered as one of the items of shop operation subject to the promotion of economy, yet in plants where such tools are used to any great extent, it is necessary to lubricate them at least once a day and in many cases oftener. Certain drills require 15 minutes to lubricate and others as high as 30 minutes. With this fact as a basis, the Chicago Pneumatic Tool Company, Chicago, Ill., carried out an extensive survey of air drill operating costs, which led to the design of an oil vent to prevent air leakage and lessen the necessity of frequently oiling these tools.

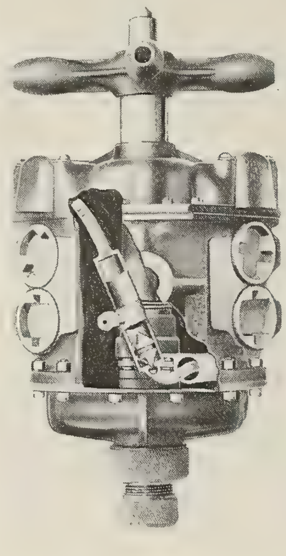
This oil vent is applicable to most sizes and types of "Little Giant" air drills. On new drills it is furnished as regular equipment, and is also attachable to drills now in use. The vent contains a sliding top-shaped plunger which automatically prevents oil leakage regardless of the operating position of the drill.

The estimated saving in time, labor and lubricant based on time and wage factors which are more or less indeterminate is shown by the following comparative figures submitted by the manufacturer:

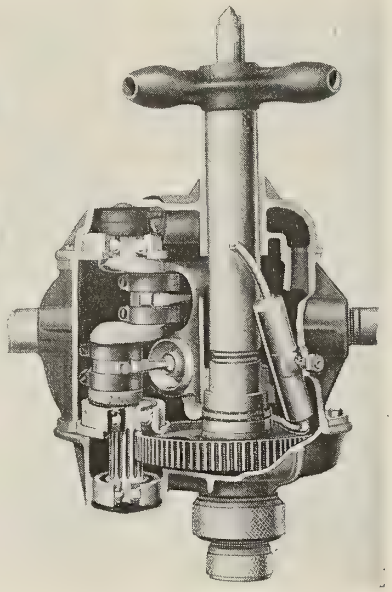
(1)	Grease per day, ½ pound, at 10 cents per pound	$0.05
	Labor per day, ½ hour, at 60 cents per hour	.30
	Total upkeep per day	$0.35
	Total upkeep cost per six-day week	$2.10
	Less one application per week for machine with vent tube	.35
	Net saving per week	$1.75
	Net saving during 52 weeks	90.00
(2)	Grease per day, ½ pound, at 10 cents per pound	$0.05
	Labor per day, ¼ hour, at 60 cents per hour	.15
	Total upkeep per day	$0.20
	Total upkeep cost per six-day week	$1.20
	Less one application per week for machine with vent tube	.20
	Net saving per week	$1.00
	Net saving during 52 weeks	52.00
(3)	Grease per day, ½ pound, at 10 cents per pound	$0.05
	Labor per day, ½ hour, at 50 cents per hour	.25
	Total upkeep per day	$0.30
	Total upkeep cost per six-day week	$1.80
	Less one application per week for drill with vent tube	.30
	Net saving per week	$1.50
	Net saving during 52 weeks	78.00
(4)	Grease per day, ½ pound, at 10 cents per pound	$0.05
	Labor per day, ¼ hour, at 40 cents per hour	.10
	Total upkeep per day	$0.15
	Total upkeep cost per six-day week	$0.90
	Less one application per week for drill with vent tube	.15
	Net saving per week	$0.75
	Net saving during 52 weeks	$39.00

One-Piece Interchangeable Toggle

Another new air drill feature applicable to all "Little Giant" air drills is known as the "Invincible" one-piece interchangeable toggle. The toggle bearing and connecting rod are integral and are secured in place in pairs by means of hinged split collars. It is claimed that this feature provides an opening at the top and bottom of the toggle bearing



Section of Vent Tube on "Little Giant" Air Drill



Vent Tube and One Piece Interchangeable Toggles

which permits the lubricant to come in direct contact with the crank pins. All parts are interchangeable, there being no inside or outside toggle, each being subjected only to the stresses of its own piston. The toggle may be assembled and dis-assembled without dismantling the drill.

Engineers' Employment Service.—An employment service for engineers of every variety of training and experience is conducted by the four National Engineering Societies of the United States. This service brings in touch with the various business men the service of 50,000 trained technical men who are members of these societies. This service is in a position to supply marine, mechanical and designing engineers, trained superintendents and other executives. It is located in the United Engineering Buildings, 29 West 39th Street, New York, under the direction of W. V. Brown and is free to both employer and to employee.

7,500-Ton Motor Tanker Oljaren, Built by Gothenburg Shipbuilding Company for Transatlantic Steamship Company

Motorship Building in Europe

New Type of Double Acting Diesel Engine—New Diesel Electric Ship—A Motor Oil Tanker

By Our Special London Correspondent

SHIPOWNERS in Europe, while admitting the superiority of the oil-engined vessel, are urging manufacturers to produce engines of much lighter construction and lower cost. With this demand in view, a great deal of experimental work has been carried out in various countries with the object of building Diesel or other oil engines less weighty than the existing type and it is a notable fact that the majority of the best-known manufacturers of marine oil engines have recently patented various devices, usually relating to double acting engines on the two cycle or four cycle principle.

A noteworthy development, however, has now been made by the production of a double acting two cycle engine by the North British Diesel Engine Works, a firm which was established for the sole purpose of building Diesel motors. Hitherto they have confined their attention to the four cycle single acting type and machinery of their design was fitted in the passenger liner *Domala*.

They first built an experimental engine of two cylinders designed to develop 240 brake horsepower at 250 revolutions per minute and, having found no troubles, as a result of series of tests they are now constructing a 2,000 brake horsepower three cylinder double acting engine of the same design, which will be installed in a single screw ship.

Scavenging Valves Eliminated and Sliding Cylinders Adopted

At first sight the engine gives the impression of being almost impracticable. The designers started with two main ideas. In the first place they wished to eliminate scavenging valves and to arrange for the scavenging air to pass right through the cylinder from one end to the other. Secondly, they desired to avoid the passage of the piston rod through the lower cylinder cover, since this not only causes trouble with packing glands but also diminishes the output of the engine. They, therefore, adopted the novel idea of having a sliding cylinder and fixed cylinder covers at the top and bottom.

There are scavenging ports at each end of the sliding cylinder, uncovered at the right moment, as the cylinder moves over the cylinder covers. The exhaust ports are in the center, one set for the lower half of the cylinder and one

for the upper. These are uncovered at the correct timing by the movement of the cylinder relative to the piston. There is no piston rod passing through the cylinder cover but the gudgeon pin is taken out through slots in the cylinder on each side and the drive is arranged on to a forked connecting rod, thus giving one crank per cylinder. The fuel is injected centrally through atomizers arranged in the top and bottom cylinder covers, in which are also located starting valves.

It will be seen from this description that not only does the cylinder with its water jacket reciprocate over the cylinder covers (which are provided with piston rings) but also the scavenging and exhaust branches, which move up and down through gas tight joints in the scavenging and exhaust trunks respectively. This would at first sight appear to be a somewhat clumsy system but the builders state that comparatively little power is needed to drive the cylinders and it must be remembered that oscillating cylinders were used with steam engines some years ago with complete satisfaction.

Weight and Space Reduced 50 Percent

The engine operates on the normal Diesel principle with air injection driving its own scavenging pump and air compressor. Some remarkable claims are made. The weight is said to be exactly half that of a corresponding four cycle engine, while the space needed is also 50 percent and is in fact the same as that required for a reciprocating steam engine without the boiler. It is thought that the cost of construction will be materially reduced and the comparative smallness of the set may be gaged from the fact that the three cylinder 2,000 brake horsepower motor now being built has a cylinder diameter of only 24½ inches and a stroke of 44½ inches.

The completion of the trials of this remarkable experimental engine has come as something of a surprise in engineering and shipbuilding circles in Great Britain and very great interest is being shown in the new development. Incidentally, as indicating the activities in the construction of internal combustion engines, it may be added that there is some likelihood of the production of a rotary marine oil engine in the near future.

Diesel Electric Drive

European shipowners have remained somewhat sceptical regarding the advantages of the Diesel electric drive for ships, as the general opinion appears to be that the cost of installation must be greater and the overall economy somewhat lower than with the direct drive. It is noteworthy, therefore, that an order has been placed with Cammell Lairds of Birkenhead for three new 6,000-ton deadweight vessels in which the Diesel electric system of propulsion will be employed. The ships are for the United Fruit Company of Boston, Mass., and will represent something of a novelty in European motorship construction.

It is especially noteworthy that the propelling plant will consist of four generators driven by Cammellaird Fullagar types of oil engine, which is claimed to be the lightest and smallest internal combustion engine on the market. It is, of course, of the opposed piston design, built in units of two cylinders cast together, diagonal links connecting the upper crosshead of one cylinder with the lower crosshead of the adjoining cylinder.

So far as can be judged there will be little difference in the weight of this Diesel electric plant as compared with the direct drive, since the engines driving the dynamos will naturally be of the high speed type and a great saving in weight will be effected. For instance they will probably run at between 250 and 300 revolutions per minute, whereas marine engines of the same total power would have to operate at not more than 100 to 110 revolutions per minute. It should be added, however, that the general impression in Europe is that while the Diesel electric drive has advantages in special cases, it is not likely to find widespread adoption.

A 7,500-Ton Motor Tanker

An increasing number of motor oil tankers are now being constructed and in addition to the oil transport companies, owners of fleets of cargo motorships are building their own tankers in order to render them to a certain extent independent of the oil transport concerns. One of the finest oil tankers recently turned out is the *Oljaren*, which was completed at Gothenburg by the Gothenburg Shipbuilding Company in June. She is for the Transatlantic Steamship Company, and the intention is to use her to carry oil either to Sweden or any other port where the Transatlantic motorships may bunker. She has a deadweight of 7,500 tons, a length overall of 399 feet 3 inches and a depth of 55 feet. The hull is divided into eleven tanks and in the pump room are installed two 250-ton per hour electrically driven pumps and one of 100 tons per hour. The arrangement is such that electric motors are fitted in the engine room and the shafts driving the pumps pass through the bulkhead dividing the engine room from the pump room.

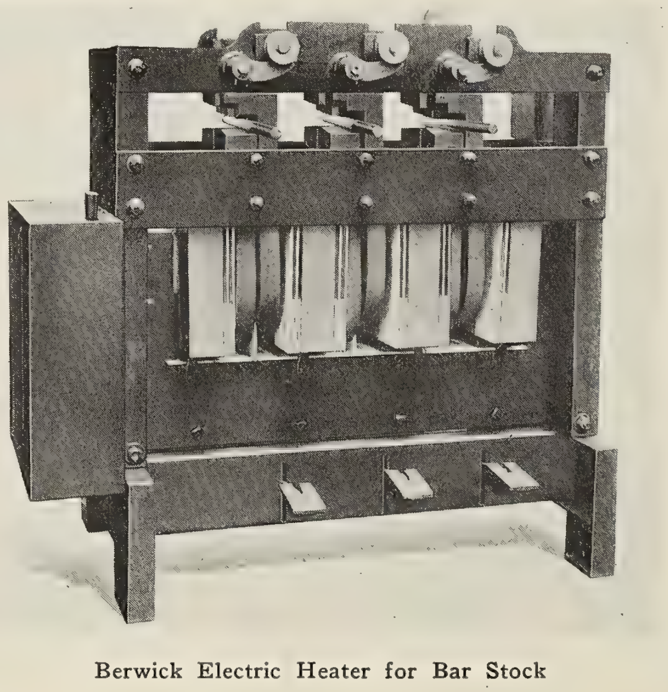
The propelling plant consists of two Burmeister and Wain type oil engines, each of 1,300 indicated horsepower. The auxiliary sets comprise three Diesel driven generators of 75 brake horsepower each driving 50-kilowatt dynamos. All other machinery is electrically operated, but there is a boiler for steaming out the tanks and another for heating the cabins.

The *Oljaren* represents the most modern type of European motor tanker, particularly in the auxiliary arrangement, since it has been customary hitherto to employ steam driven cargo pumps, even in motor tank ships. The daily fuel consumption of this vessel for a speed of about 10½ knots is about 8 tons.

Two Path Electric Heater

A BERWICK electric heater for heating the ends of stock to be used in forging operations has been developed by the American Car and Foundry Company, New York. The heating is accomplished without burning or melting the metal and so that an even heat is distributed through the metal at all times.

The heaters are built with one, two, three and if desired with four or five electrodes. The range of heat runs from 1 inch to 8 inches or from 3 inches to 11 inches, with the



Berwick Electric Heater for Bar Stock

possibility of increasing the length by slight changes in the standard heater to 16 inches or 18 inches. Stock $\frac{3}{8}$ inch to $\frac{7}{8}$ inch in diameter may be heated to best advantage on the type machine illustrated, while for larger stock a type 4 machine should be used.

The operation of the heater is along the lines of the Berwick rivet heater. The lower or left hand electrodes are stationary while the upper or right hand electrode is arranged with a vertical adjustment by depression of the foot treadle, which raises the electrode sufficiently to insert or remove the material. Horizontal motion is provided by sliding the electrode clamping device along the shaft provided for the purpose, while as indicated the vertical motion is imparted to the electrode by the depression of the pedal, thus causing the rotation of the shaft, which in turn through cams raises the shaft carrying the electrode.

The material to be heated is inserted between the top and bottom electrodes and due to the double path the time of heating is reduced and the possibility of pitting is not so great. Flexibility of the rear portion of the bottom electrode is provided by the spring shown in the illustration on the rear of the heater, the top face of the electrode being set on an incline so that when the top electrode is dropped in position contact is assured at four points on the material.

Machine for Calking Wood Decks

THE many difficulties generally found in adapting a machine for wood deck calking purposes have been overcome, it is claimed, in an apparatus developed by John McDowall and Sons, Johnstone, near Glasgow, Scotland, known as the "Clyde" deck calking machine. A feature of the machine is an "extended seam" attachment which consists of a hollow guideway so constructed and placed as to form an outward and upward extension of the seam to be calked. Through the tapered opening thus formed by the walls and the guideway, the oakum is compressed by the hammer and enters the seam in a partially

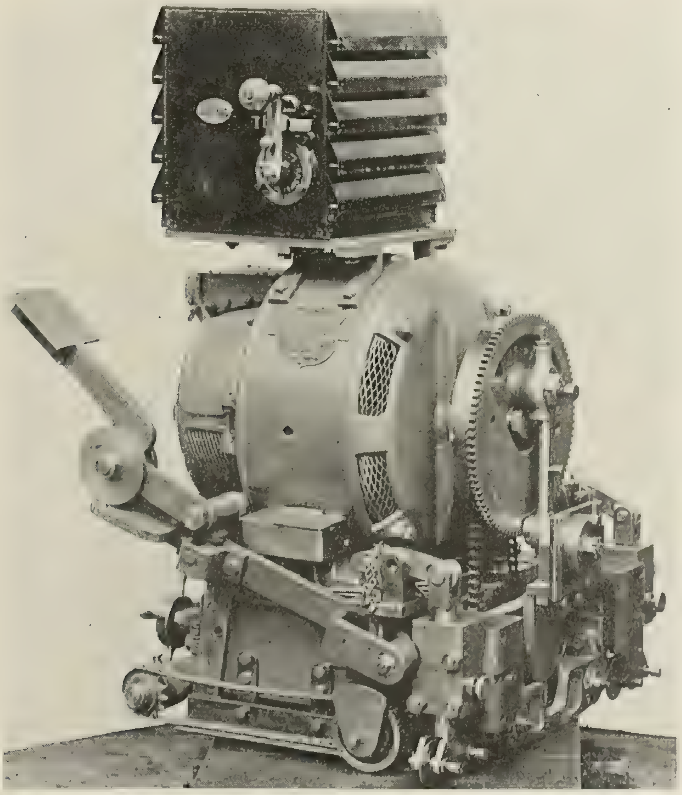


Fig. 1.—Clyde Deck Calking Machine in Position for Traversing

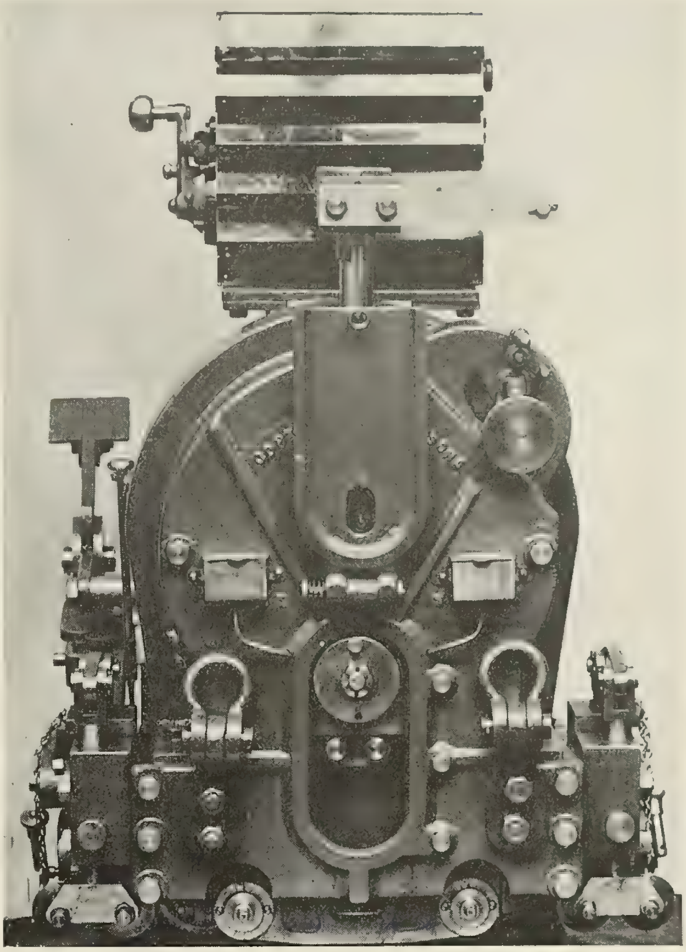


Fig. 2.—Rear View of Calking Machine, Showing Fluted Rollers and Cross Travel Gear

compressed state where it is easily driven into place by the point of the hammer. This hammer is tapered to correspond with the walls of the extended seam and the vertically reciprocating stroke is intended to compress the material into a thread of suitable size to be driven into the crack.

Fluted rollers are fitted to the base of the machine which grip the deck and travel in either direction and which are used for traversing the machine. The calker is kept in alinement with the seam by means of tapered wheels placed in front of and behind the hammer. These wheels adapt the operation to the many irregularities found in even the best laid planking. The oakum thread is wound upon a bobbin which carries about 450 feet, the supply to the tool being automatic.

A special 3 brake horsepower reversing motor, which can be wound to suit either direct or alternating current, furnishes power to the machine. A reversing controller is mounted on the top of the motor as well as the necessary electrical resistance.

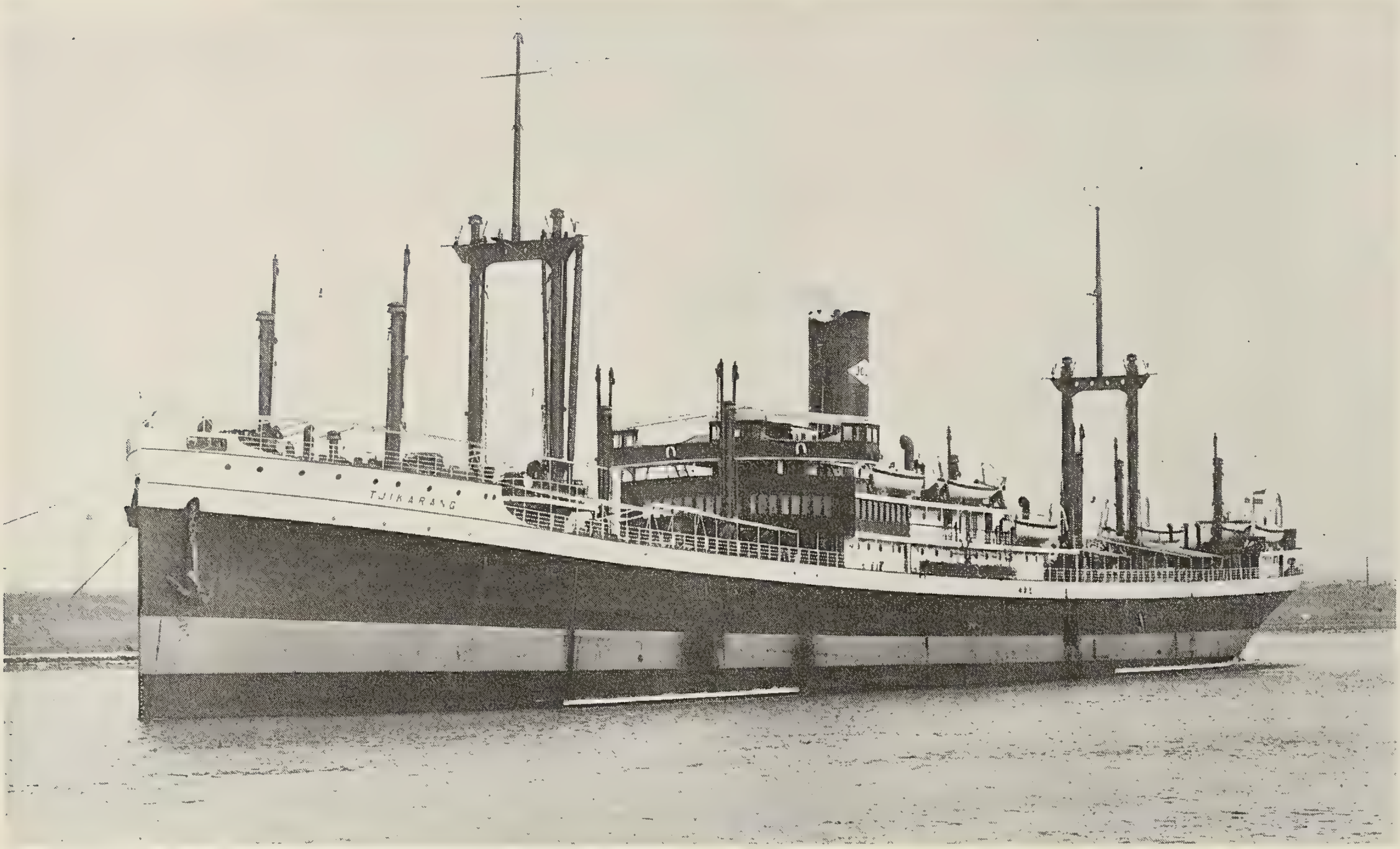
A cross-travel gear, operated by means of a foot lever, is also fitted to the machine for the purpose of shifting from seam to seam. When the foot pedal is depressed the machine is lifted on to the wheels placed to travel at right angles to the seam and by the same operation the seam guide wheels are lifted clear of the deck. A handle is then used to wind the machine across to the next seam. When the machine is again in position the oakum is threaded with a special tool and the calker is ready to start.

With the controller thrown in the machine runs without attention until it reaches the end of the seam automatically drawing the oakum as required from the bobbin. The machine will operate in either direction by simply throwing over the controller handle and altering the lead of the oakum.

Passenger Ship Requirements from American, British, French, German, Italian and Spanish Emigration Laws; also United States Lines' Practice

	U. S. Steamboat Inspection Service — Passengers	U. S. Steamboat Inspection Service — Crew	British Board of Trade	French	German	Italian	Spanish	U.S. Lines' Practice. The Practice of the U. S. Lines Is to Provide Comfortable Rooms for Third Class Passengers and Is as Follows:
Baggage space					17.6 cu. ft. per person.			Sufficient baggageroom space.
Bath and washrooms	Sufficient number.	Separate washrooms for deck and engine departments. 1 wash basin for every two men on watch. Sufficient number of baths.	5 basins per 100 3rd cl. passengers; 1 wash trough for every 100 women; 1 wash trough for every 200 men; 3 basins per 100 passengers when basins are fitted in rooms; 1 bath tub per 100 women; 1 bath tub per 100 men (half may be showers)		1 washroom for men and 1 for women; 2 wash basins per 100 passengers; bath and showers required if vessel sails below 30° north latitude; washrooms not required where basins are fitted in rooms.	1 washroom each, men and women, forward; 1 washroom each, men and women, aft; 5 laundry tubs for each washroom; 2 wooden tubs of at least 13-gallon capacity, additional; sufficient bathtubs, showers and basins.		1 wash basin and toilet cabinet in each 2 or 4 berth s.r.; 2 in each 6-berth room; 3 basins in washrooms for every 100 passengers; 1 wash trough for every 100 women; 1 wash trough for every 200 men; 1 bathtub for every 100 women; 1 bathtub for every 200 men; 1 shower for every 200 men.
Berths	Size, 2′x6′; height over deck, 6″; height between berths, 2′ 6″; height under deck, 2′ 6″. Two tiers of berths, only, regardless of deck height. To be separated by partial partitions.	Size, 2′x6′; height over deck, 6″; height bet. berths, 2′ 6″; height under deck, 2′ 6″; two tiers of berths only.	Size, 22″x6′; height over deck, 12″; height between berths, 2′ 6″; height under deck, 2′ 6″; two tiers of berths only.	Size, 22 1/32″ x 6′; height over deck, 5⅞″; height between berths, 2′ 3½″; sufficient number of berths required 2′ 7½″ in width.	Size, 23⅝″x6′; height over deck, 5⅞″; hght. under deck, 2′ 5 9/16″; two tiers of berths only to be separated by low boards.	Size, 22 1/32″ x 5′ 10⅞″; height over deck, 15¾″; height between berths, 2′ 3½″; height under deck, 2′ 3½″; 10% of berths in all compartments to be 2′ 7½″ in width.	Size, 19 11/16″ x 5′ 10⅞″; 6% in women's compartments to be 2′ 7½″x6′; height over deck, 15¾″; height between berths, 23⅝″; 3 high allowed when deck height is over 7′ 6½″.	Size. 2′ 2″x6′ 3″; height over deck, not less than 18″; height bet. berths, not less than 2′ 6″; height under deck, not less than 2′ 6″; min. size of 4 berth room, 7′ x 6′ 4″; min. size of 2 berth room, 4′ 9″x6′ 4″; leeboards provided for all berths.
Deck space below	36 sup. ft. for every 1st cl. passenger, 18 sup. ft. for every 3rd cl. passenger, above lowest passenger deck; 21 sup. ft. for every 3rd cl. passenger on the lowest passenger deck. *Where allowance is made for public rooms:* 15 sup. ft. for every 3rd cl. passenger above the lowest passenger deck; 18 sup. ft. for every 3rd cl. passenger on the lowest passenger deck.	16 sq. ft. for each seaman; 120 cu. ft. for each seaman.	36 sup. ft. for every 1st cl. passenger; 15 sup. ft. for every 3rd cl. passenger above the lowest passenger deck. 18 sup. ft. for every 3rd cl. passenger on the lowest passenger deck. *Where allowance is made for public rooms:* 12 sup. ft. for every 3rd cl. passenger above lowest passenger deck. 15 sup. ft. for every 3rd cl. passenger on the lowest passenger deck.	Main deck: 97.1 cu. ft. per 3rd cl. passenger. Lower decks: 105.9 cu. ft. per 3rd cl. passenger.	100.6 cu. ft. per 3rd cl. passenger (considering 7.87′ as a maximum deck height.)	Main deck: 97.1 cu. ft. per 3rd cl. passenger. Lower decks: 105.9 cu. ft. per 3rd cl. passenger. (Considering 8.2′ as a maximum deck height).	97.1 cu. ft. per 3rd cl. passenger. (Considering 8.2′ as a maximum deck height).	Greater deck space than required in the various emigration laws is provided as third class passengers are carried in rooms.
Deck heights	6′.		6′		6′	7′ 2 9/16″.	7′ 6½″ where berths are 2 high.	
Deck space, promenade	5 sq. ft.		5 sq. ft.		2.68 sq. ft.	4.84 sq. ft.	4.84 sq. ft.	Not less than 5 sq. ft. per person.
Doors			Equal in width to stair ways to which they give access.			2′ 7½″.		Not less in width than stairways to which they give access. Fixed blinds in s.r. doors for exhaust vent.; min. size of doors, 6′ 6″x2′ 2″.
Hatches						To be covered with wooden gratings on main deck and above in addition to hatch covers.		
Hatches, booby	To be fitted on all ladders opening into the weather. 6″ coaming required.		Hinged flaps and doors not acceptable. Must be of substantial hood type.					Booby hatches to be fitted on all ladders opening into the weather.

Hospitals	Two compartments. 1 for men, 1 for women. 18 sup. ft. deck space for every 50 passengers carried.	1 compartment; 1 berth for every 12 seamen, provided that not more than 6 berths are required.	Three compartments; 1 for men, 1 for women, 1 isolation hospital. General Hospitals: 24 sup. ft. for every 50 passengers carried; 96 sup. ft. total deck area.	3 compartments: 1 for men, 1 for women, 1 isolation hospital. General Hospitals: 1 berth every 40 persons up to 200; 1 berth every 60 persons over 200; 141.25 cu. ft. per person. Deck height, 6'.	2 compartments: 1 for men, 1 for women, 2 berths for every 100 passengers; 176.55 cu. ft. per person; 3' 4" clear space alongside of each berth.	3 compartments: 1 for men, 1 for women, 1 isolation hospital. berths to number 2% and 1% respectively of the total number of passengers carried. 123.59 cu. ft. per person.	3 compartments: 1 for men, 1 for women; 1 isolation hospital; berths to number 4% of the total number of passengers; 123.59 cu. ft. per person.	3 compartments: 1 for men, 1 for women, 1 isolation hospital: 24 sup. ft. for 50 passengers, or 48 sq. ft. per hospital, or 2 berths per 100 passengers; 3' 4" clear space alongside each berth.
Lighting	Sufficient electrical illumination.	...	Sufficient electrical illumination.	...	2 standard electric light fixtures and 2 emergency lights for every 100 passengers.	6 to 10 electric lights in each compartment; 4 to 6 emergency lights in each compartment; 2 electric lights in every hatch trunk used for access.	...	1 electric light in each stateroom: 10-12 electric lights in passages of each compartment; 4-6 emergency lights in each compartment; 2 electric lights in each hatch trunk used for access.
Passages	...	...	Not less in width, between cabins, than inside measurement of berth.	...	23⅝"	2' 7½".	2' 3⅜". 23⅝" between cabins.	2' 6" clear for main passageways. 2' 3" clear for thwartship passageways.
Rails	...	...	6" max. clearance between rails on open deck.	...	...	...	...	6" maximum clearance between rails on open deck and access ladders.
Air ports	Sufficient number.	...	At least 9" in diameter.	...	Sufficient number.	Not required on lower deck, but 2 Utley's patented ventilating ports must be fitted in every compartment.	...	Staterooms arranged so that there is at least one port light in each outboard room and one each at ends of thwartship passageways.
Stairways	Sufficient number.	...	2" width for every 5 passengers carried in a compartment.; 30"-50" clear breadth for single and double stairways respectively; 6' clear headroom above each stair; 37° heel where possible.	Width, 2' 7½": 1 stairway for 50 passengers; 2 stairways for 50 to 150 passengers; 3 stairways for 150 to 200 passengers; 4 stairways for 200 or over.	Clear breadth, 2' 7 1/16": 1 for 100 passengers or less; 1 for every 100 passengers up to 400; 1 for every 150 passengers over 400. (Not less than four).	Clear breadth, 2' 7½": 1 stair for 1 to 50 passengers; 2 stairs for 51 to 150 passengers; 3 stairs for 151 to 200 passengers; 4 stairs for 200 and above; 1 stairway must lead to clear deck for every 100 passengers carried below. 35° heel.	Width, 2' 3⅜"; 1 permanent stairway that can be used while loading or discharging cargo.	2" width for every 5 passengers carried in a compartment: 30"-50" min. clearance for single and double stairways, respectively; not less than 6' clear headroom above each stair. Rake, 42° where practicable.
Ventilation, natural	2 ventilators, 12" dia. for every 50 passengers.	...	5 sq. in. area per passenger; 2 vents for 75 passengers and under; 3 vents for 76-125 passengers and under; 4 vents for 126 or more passengers and under; diameters, 10" min., 20" max.; ventilators not to exceed 314 sq. in. in area.	Sufficient ventilation	2 vents, 11⅜" in dia. in each compartment carrying 100 passengers where more than 100 passengers are berthed in one compartment, the number of vents will be increased proportionally.	2 vents each .75 sq. ft. area for 50-100 persons; 3 vents each .75 sq. ft. area for 101-200 persons; 4 vents, each .75 sq. ft. area for 201 or more; ventilators of larger area than .75 sq. ft. count only as one ventilator.	1 vent, 7⅞" dia. for 25 to 100 persons; 2 vents, 7⅞" dia. for 100 to 200 persons; 4 vents, 7⅞" dia. for 200 or more persons. *Where vent area is less than above:* Only 90% of the passengers may be carried.	To conform to all emigration laws.
Ventilation, forced	...	...	When ventilation is mechanical at least 830 cu. ft. of air per hour must be delivered for each passenger.	...	...	Every compartment on lower deck must have at least 2 independent electrical sup. blowers of 1,765.5 cu. ft. per minute capacity.	...	Forced ventilation used throughout; ducts with louvre controls to be led to each stateroom.
Water	4 quarts per day per 3rd class passenger.	Sufficient quantity.	4 qts. per day per 3rd cl. passenger; ample amount to cabin passengers and crew; 10 gals. per day for cooking purposes for every 100 persons on board.	...	...	...	...	1 drinking fountain in each 3rd cl. compartment. 5 gals. per day per 3rd cl. passenger.
Water closets	At least two. 1 w. c. for every 100 men. 1 w. c. for every 50 women.	Sufficient number.	4 w.cs. for every 100 passengers up to 300; 2 w.cs for every additional 100; 2 urinals for every 100 male passengers up to 300. 1 urinal for every 100 passengers beyond that number. Trough type not allowed.	2 w.cs. for 100 passengers and under; 1 w.c. for every additional 75 passengers.	1 w.c. for every 50 passengers.	2 w.cs. for 1st 100 passengers; 2 w.cs. for every 150 passengers beyond that number.	Men w.cs. / Women w.cs. / No. of Pass. 2 / 1 / 100 or less 3 / 2 / 100 to 250 5 / 2 / 250 to 450 6 / 3 / 450 to 700 8 / 4 / 700 to 1,000 1 / 1 for every additional 200 passengers.	4 w.cs. for every 100 passengers up to 300; 2 w.cs. for every additional 100 passengers; 2 urinals for every 100 male passengers up to 300; 1 urinal for every 100 passengers over 300; ratio: men and women carried, 3:2. All w.cs. are individual.



S. S. Tjikarang, Built for the Java-China-Japan Line by the Netherland Shipbuilding Company, Leaving Amsterdam for Her Trial Trip

Cargo Steamer Tjikarang Has Limited Passenger Accommodations

WHAT is said to be the largest cargo steamer ever built in Amsterdam, Holland, was completed early this year by the Nederlandsche Scheepsbouw-Maatschappy (Netherland Shipbuilding Company) for the Java-China-Japan Line, Batavia. The *Tjikarang,* as the vessel is named, has a length of 485 feet, a beam of 60 feet, a depth of 40 feet 6 inches and a deadweight capacity of 13,175 tons. Although a cargo steamer, the *Tjikarang* has accommodations for 12 first class passengers, consisting of a dining saloon, smoking room, staterooms for one and two persons, bath rooms, etc. In the 'tween deck space there is room for 1,800 natives.

The vessel has two double masts, 8 derrick posts and also a derrick of 30 tons' capacity. Cargo is handled by means of 20 steam winches. The vessel is electrically lighted, has a steam heating installation and cooled provision holds.

Propulsion is by a triple expansion engine of 5,000 indicated horsepower supplied by Werkspoor of Amsterdam, designed to give the vessel a speed of 12½ knots. The vessel was built to Lloyd's highest class.

Smoking Room

First Class Dining Saloon

The New M. A. N. Diesel Engine

Four Cycle Type Now Being Built in Germany —First Units to Be Installed on Hansa Freighter

By Our Special London Correspondent

IT is a remarkable fact that oil engine builders in Germany, which was originally the home of the two cycle Diesel engine, are now for the main part reverting to four cycle machinery. It is believed this is largely due to the failures of the two cycle engines in submarines during the war and the undoubted success of the four cycle design, particularly that built by the M.A.N. This concern has now developed a four cycle marine type for cargo ships, the design being quite different in many respects from other engines of this class. It is standardized as a 1,600 brake horsepower plant and twin screw sets will be installed in many of the new German motorships which are now being constructed in the rebuilding of Germany's mercantile fleet.

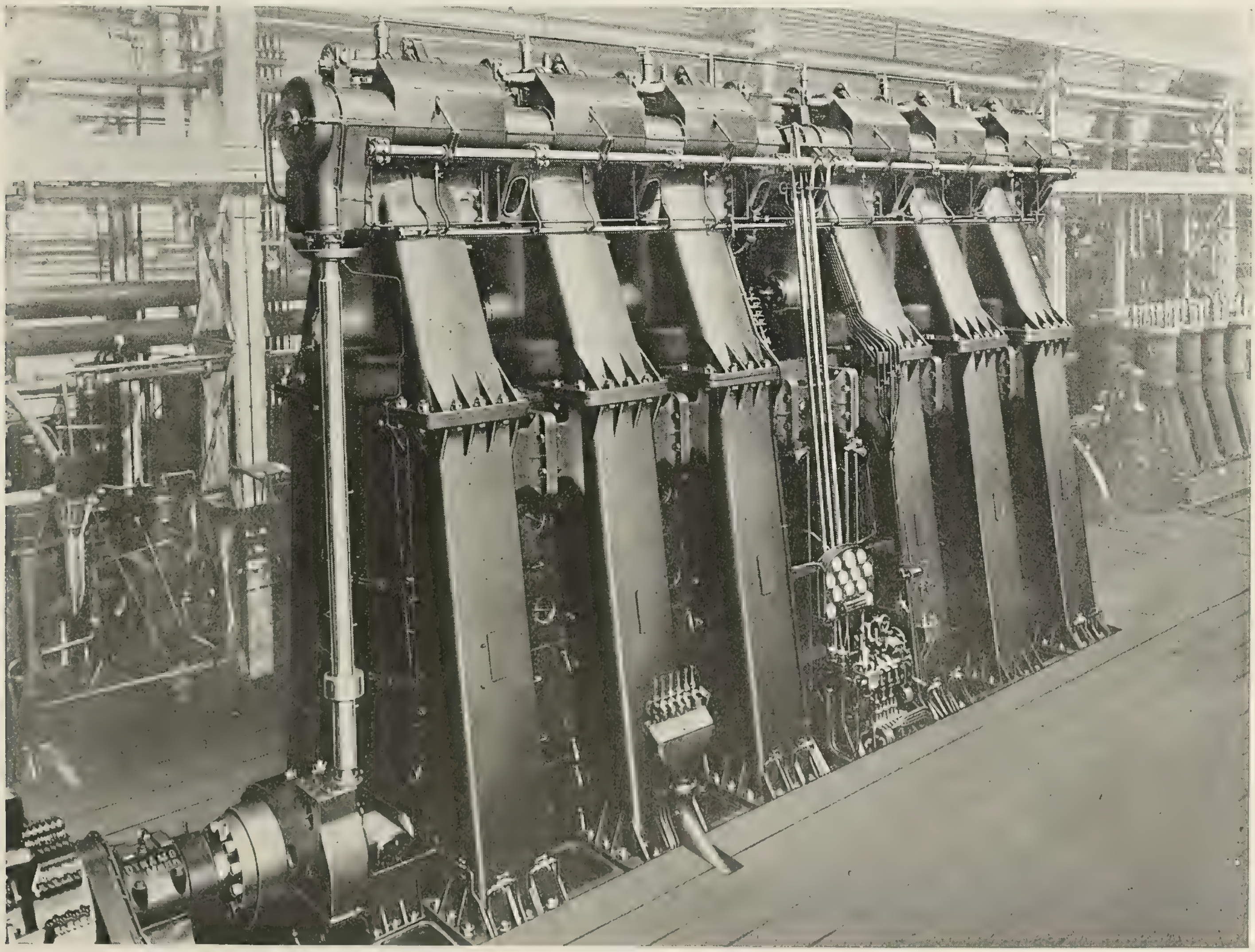
To Run on Boiler Fuel Oil

It has six cylinders 700 millimeters by 1,200 millimeters and runs at 100 revolutions per minute. It is of the air injection type, but instead of driving the air compressors at the end of the engine, as is now common, they are operated from beam levers, two three-stage air compressors being fitted.

The engine is designed to run on boiler fuel oil or, if necessary, on tar oil, as this latter can be obtained at moderate prices in Germany. In order to accomplish this the designers have carried out an idea that has been utilized in Germany with land engines for some years past. A small quantity of lighter oil is allowed to enter the cylinder through the fuel valves just before the piston reaches the top of its stroke and prior to the admission of the main body of the fuel oil. With the rise in pressure consequent upon the ignition of this small quantity of light oil, the temperature is raised sufficiently to allow the heavier fuel to be satisfactorily burned.

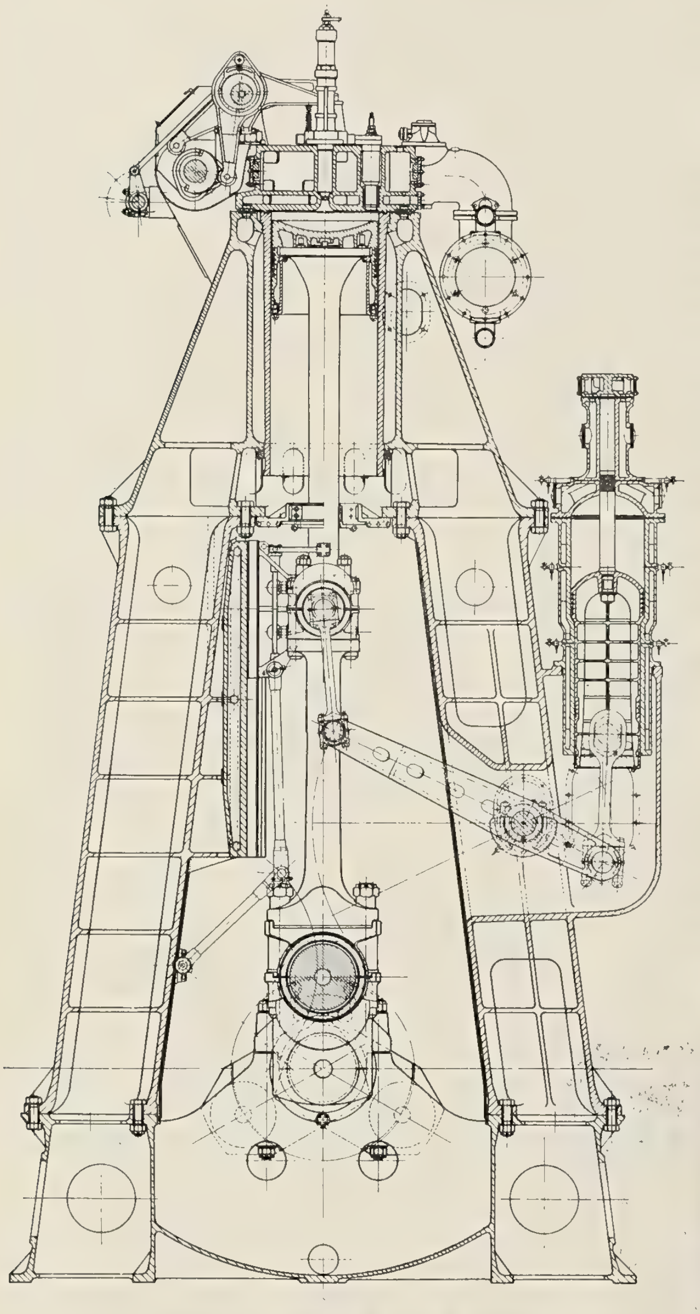
Method of Cooling Cylinder Cover

The builders have evolved a cylinder cover design which appears to be peculiarly efficient. Since cylinder cover cracks, when they occur, naturally develop in the section of the cover next the point of maximum temperature (that is



First of the New Four Cycle M. A. N. Diesels of 1,600 Brake Horsepower Erected at the Builders' Shop

to say, close to the fuel valve), it is of the utmost importance that the cover should be effectively cooled at this section. In order to accomplish this, the builders of the M.A.N. engine have arranged that the speed of the cooling water around the fuel valve shall be greater than in other parts of the cover where the cooling effect is not so essential. They have therefore divided the cylinder cover by a horizontal partition wall and through the lower half the cooling



Section of New M. A. N. Engine

water passes with fairly high velocity. It is allowed to enter the upper section of the cylinder cover through holes cut in the division wall.

Pistons Cooled With Lubricating Oil

It is somewhat surprising to find that the pistons are cooled with lubricating oil instead of water. A flange is forged on the top of the piston rod and this is pressed up against ribs cast within the piston crown. The joint between the crown and the piston flange is maintained through a bush as indicated on the sectional drawing. The ribs on the piston crown, besides giving ample surface for the cooling oil, are so arranged that the oil, flowing up through a hole in the piston rod, passes to the outer section and then through the various divisions formed by the ribs before being discharged from the engine through a tube in the center of the piston rods.

A very rigid form of cylinder cover construction is adopted, each cylinder being supported from two columns, while the columns themselves are joined together with bolted flanges at the top. The cylinder jackets are splayed out at the bottom for attachment on the flanges of the columns, and the bearings carrying the camshafts are supported from the cylinder structure.

Valve Mechanism

The camshaft is driven from the crankshaft through bevel gearing and vertical spindle as seen in one of the illustrations. There are ahead and astern cams for actuating the fuel, starting, exhaust and inlet valves and the camshaft is moved in a longitudinal direction when reversing. The reversing mechanism is operated through the usual oil servo motor, control for which is effected from the engine room floor level.

There are two levers, each controlling three cylinders, and the normal method of starting up is adopted by which six cylinders are placed on starting air, then, three are turned over to fuel oil and finally all six switched over to oil. A hand starting and maneuvering mechanism is provided in the event of failure of the servo motor gear.

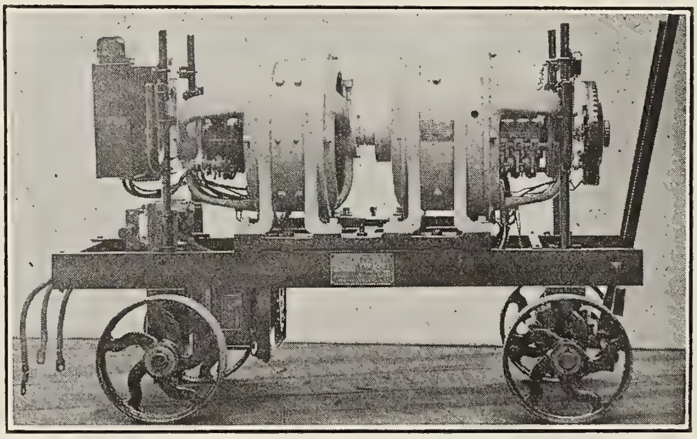
Over the top of the crankcase for each cylinder is a tray which collects the lubricating oil that may fall from the piston, this being delivered through filters and used over again.

The first two engines are to be installed in a motor cargo ship of about 6,500 tons gross, now being built for the Hansa Line.

A Large Capacity Welding Set

A PORTABLE welding outfit of increased capacity is now being built by the U. S. Light & Heat Corporation, Niagara Falls, N. Y. It consists of a motor-generator set and control apparatus mounted on a four-wheel hand truck.

The generator has a continuous capacity of 300 amperes, and for cutting and other work of an intermittent nature will develop 400 amperes. It is designed with inherent regulation and has the same characteristics as the 200-ampere machine made by the same company. The generator is also furnished for belt or gas engine drive.



The 350-Ampere U. S. L. Welding Set

The set is supplied with either a direct or alternating current motor and weighs complete about 1,700 pounds.

United States Navy's Research of Ship Bottom Paint

By N. E. Adamson*

The following article has been prepared from the author's notes on research pertaining to ship bottom paints during the past 12 years, augmented by data drawn from the files at the Norfolk Navy Yard, where most of the Navy's research on this subject has taken place. Because of the great volume of data, a brief description of the tests and the history of the research is given rather than a technical discussion of the subject. For obvious reasons the trade names of proprietary paints and materials are omitted.

TWENTY years ago the Navy used commercial ship bottom paints, purchasing them after the receipt of competitive bids. In order to submit bids for ship bottom paints it was necessary that a manufacturer succeed in getting his paints recognized at the Navy Department and listed as acceptable. The paint used was therefore limited to certain brands and, of these, two or three became more extensively used than the others.

It soon developed that each Navy Yard, where ship bottoms were painted, was forced to maintain stocks of varnish, grease and soap paints of various brands. If a bottom had been painted with a grease paint and required repainting, it was necessary again to use a grease paint or clean off all the old grease paint before applying a spirit varnish paint. Failure to do this was believed to invite unfavorable results from the last applied paint. The docking of ships had to be anticipated sufficiently in advance to allow the yard time to procure the particular brand of paint needed if it was not on hand. It was therefore not unusual to have a supply of anti-corrosive and anti-fouling paints from six different manufacturers in a yard at one time.

It does not appear that the cost of ship bottom paints was considered further than in awarding contracts. The costs of the paints, in general, were approximately $2.10 per gallon for anti-corrosive and $3.25 per gallon for anti-fouling paint. Some paints were purchased by the pound or hundredweight, the costs being approximately $0.20 and $0.30 respectively per pound or $21 and $33 respectively per hundredweight. The saving that the Navy could realize in "first costs" does not seem to have been advanced as a reason for undertaking the manufacture of ship bottom paints, and the fact that a very great saving could be realized only became apparent after the manufacture started, or six years after the first steps were made toward developing formulæ. In the beginning, the manufacture of ship bottom paints by the Navy Department was an effort to standardize—to make it possible to have all the bottoms painted with the same paints so as to require a minimum of paint in stock at Navy Yards and that paint of a constant quality available for any ship's bottom.

*Assistant shop superintendent, United States Navy Yard, Norfolk, Va.

Problems Presented on Starting to Manufacture Ship Bottom Paints

The first official action toward this standardization appears in a Navy Department (Bureau of Construction and Repair) letter dated February 13, 1902 and addressed to the Commandant, Navy Yard, Norfolk, Va. In this letter the bureau requested the commandant to direct the naval constructor to consider the advisability of manufacturing, for the Navy's use, a bottom paint of good quality and to report concerning the cost of establishing a factory for producing the paint in large quantities.

At this time, Rear Admiral C. S. Cotton, U.S.N., was

Table 1—Compositions of the First 21 Experimental Paints Used in Deriving Formulae for U. S. Navy Ship Bottom Paints. A. C. Denotes Anti-Corrosive Paint. A. F. Denotes Anti-Fouling Paint

PERCENT OF COMPOSITION BY WEIGHT [APPROXIMATE]

Formula Number	Wood Alcohol	Grain Alcohol	Gum Shellac	Zinc Oxide, dry	Indian Red, dry	Venetian Red, dry	Glycerine	Creosote	Gum Mastic	Pine Tar Oil	Arsenic	Turpentine	Zinc Sulphate	Corrosive Sublimate	Boiled Linseed Oil	Mercuric Oxide	Benzine	Metallic Zinc (Zinc Dust)	Bitter Aloes	Mercuric Cyanide
1-A.C.	35.6	...	4.9	40.5	19.3	...	2.5	0.7	...	...	...	...	...	...	...	...	...	...	...	...
2-A.F.	36.8	...	5.5	22.2	...	22.2	...	0.7	0.7	11.5	0.7	...	...	...	...	...	...	...	...	...
3-A.C.	...	28.2	12.7	33.9	8.5	...	...	...	...	8.8	...	7.7	...	...	...	...	...	...	...	...
4-A.F.	...	19.6	5.9	23.6	...	23.6	...	...	...	12.3	...	10.7	2.9	1.5	...	...	...	...	...	...
5-A.C.	...	28.2	12.7	42.4	...	...	...	...	...	8.9	...	7.7	...	...	...	...	...	...	...	...
6-A.C.	...	42.3	8.4	16.1	...	...	...	...	...	16.7	...	...	...	..	16.2	...	...	...	...	...
7-A.F.	...	25.4	11.8	15.5	...	7.8	...	...	...	16.4	1.9	21.1	...	...	...	...	...	...	...	...
8-A.F.	...	19.6	5.9	23.6	...	23.6	...	...	...	12.3	...	10.7	2.9	...	...	1.5	...	...	...	...
9-A.F.	...	20.0	6.0	24.0	...	24.0	...	...	...	12.5	...	0.7	...	...	...	0.8	11.8	...	...	...
10-A.C.	...	28.3	12.8	34.0	8.5	...	...	...	...	8.9	...	...	...	...	...	...	7.6	...	...	...
11-A.F.	...	19.6	8.9	23.6	...	23.6	...	...	...	12.3	...	...	...	0.8	...	0.7	10.5	...	...	...
12-A.C.	...	23.4	10.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	64.3	1.7	...
13-A.F.	...	37.4	7.5	...	...	15.0	...	...	...	...	...	13.8	3.7	...	...	...	...	15.0	3.8	3.7
14-A.C.	...	28.7	6.6	10.8	...	...	...	...	...	...	...	15.5	...	...	...	...	...	38.7	...	...
15-A.C.	...	37.8	8.5	12.8	...	...	...	...	...	...	...	2.7	...	...	...	...	...	38.3	...	...
16-A.C.	...	37.8	8.5	25.6	...	...	...	...	...	...	...	2.7	...	...	...	...	...	25.6	...	...
17-A.C.	...	37.6	8.0	37.9	...	...	...	...	...	...	...	2.5	...	...	...	...	...	14.1	...	...
18-A.C.	...	43.3	10.2	32.5	...	...	...	...	...	7.5	...	6.6	...	...	...	...	...	...	...	...
19-A.F.	...	30.5	13.5	18	...	18	...	...	...	9.6	...	8.1	...	...	...	2.2	...	...	...	...
20-A.F.	...	37.0	8.3	27.7	...	...	...	...	...	23.3	...	...	...	3.7	...	...	...	...	...	...
21-A.F.	...	31.5	9.4	18.9	...	...	...	...	...	9.8	...	8.7	...	3.1	...	...	...	...	...	...

Table 2—Composition and Tests of Second Series of Experimental Paints Used in Deriving Formulae for U. S. Navy Ship Bottom Paints. A. C. Denotes Anti-Corrosive Paint. A. F. Denotes Anti-Fouling Paint

PERCENT OF COMPOSITION BY WEIGHT (APPROXIMATE)

Formula Number	Beef Tallow	Bees Wax	Chrome Green	Lampblack (in Oil)	Copperas	English Rosin	Laundry Soap	Mercuric Oxide	Methyl Alcohol	Gum Shellac	Zinc Oxide	Indian Red	Pine Tar Oil	Turpentine	Venetian Red	Grain Alcohol	Gum Elemi	"Burning Pitch"	Zinc Dust	Corrosive Sublimate	Gum Sandarac	Sulphur	Spar Varnish	Gum Euphorbium	Arsenic	Rosin	Zinc Sulphate	Boiled Linseed Oil	Japan Drier	Period of Test	Results
22-A.F.	22.2	6.7	11.2	6.7	4.4	40.0	7.8	1.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4 months.	Good. Few barnacles.
23-A.C.	...	...	...	...	...	...	...	...	51.1	8.7	23.0	6.5	6.5	4.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	....	Put on bottom that did not dock here again. No data.
24-A.F.	...	...	...	...	...	...	...	1.0	36.0	8.1	18.6	...	10.5	7.2	18.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...		
25-A.C.	...	...	...	...	...	...	...	...	...	9.8	19.5	9.8	11.1	7.5	...	32.9	9.8	...	...	...	...	...	...	...	...	...	...	...	...	No record.	Plate test gave unsatisfactory results.
26-A.F.	...	...	...	...	...	...	...	2.0	...	23.8	...	...	...	...	17.8	40.0	...	5.9	...	...	...	...	...	...	...	...	...	...	...		
27-A.C.	...	...	...	...	...	...	...	...	...	3.7	22.0	7.3	...	22.8	...	37.0	7.3	...	...	...	...	...	...	...	...	...	...	...	...	Jan. 19, 1907, to Mch. 17, 1907.	Plate test. Excellent condition. No grass, barnacles or blisters.
28-A.F.	22.0	6.6	11.0	6.6	4.4	39.6	7.7	2.2	...	...	...	...	...	...	...	9.2	...	...	...	...	...	...	...	...	...	...	...	...	...		
29-A.F.	...	...	...	...	...	...	...	1.4	...	13.5	18.2	18.2	10.4	.9	...	39.0	...	...	...	...	...	...	...	...	...	...	...	...	...	Feb. 13, 1907, to May, 1908.	Tested on U. S. S. Hornet. Excellent condition. Few barnacles and patches of grass.
30-A.C.	...	...	...	...	...	...	...	...	...	8.3	15.2	5.2	10.0	...	...	53.5	...	...	6.9	...	...	...	...	...	...	...	...	...	...		
31-A.F.	...	...	...	...	...	...	...	...	...	13.5	18.2	18.2	10.0	9.2	...	30.2	...	...	...	0.8	...	...	...	...	...	...	...	...	...	Same as 29.	Same as No. 29.
32-A.C.	...	...	...	...	...	...	...	...	...	11.4	11.4	5.7	12.8	11.4	...	35.7	...	...	...	...	11.4	...	...	...	...	...	...	...	...	Mch. 18, 1907, to May 24, 1907.	Plate test. Results unsatisfactory.
33-A.F.	...	...	...	...	...	...	...	...	...	8.5	...	...	9.5	5.6	54.0	14.3	...	...	...	...	...	2.1	3.7	...	...	...	...	...	...		
34-A.C.	...	...	...	...	...	...	...	...	...	14.1	19.0	...	...	...	...	32.1	...	...	19.0	...	...	...	...	14.1	...	...	...	...	...	4 months.	Plate test. Very good results. No fouling but a few blisters.
35-A.F.	...	...	...	...	...	...	...	4.9	...	9.8	13.2	...	...	...	26.2	22.9	...	...	13.2	...	...	...	...	9.8	...	...	...	...	...		
36-A.F.	...	...	...	...	...	...	...	...	...	10.0	13.5	...	...	...	26.9	23.6	...	...	13.5	2.5	...	...	...	10.0	...	...	...	...	...	4 months.	Plate test. Results very good.
37-A.F.	...	...	...	...	...	...	...	4.6	...	9.0	12.0	...	...	...	24.1	21.0	...	...	12.0	2.3	...	...	...	9.0	6.0	...	...	...	...	4 months.	Plate test. Results good.
38-A.F.	...	...	...	...	...	...	...	...	...	41.0	...	20.5	...	...	...	36.0	...	...	...	2.5	...	...	...	...	...	...	...	...	...	Mch. 26, 1907, to May 24, 1907.	Plate test. No fouling.
39-A.C.	...	...	...	...	...	...	...	...	...	11.8	47.0	...	13.8	...	...	27.2	...	...	...	...	...	...	...	...	...	...	...	...	...	May to Sept., 1907.	Plate test. Film broken. Fouled.
40-A.F.	...	...	...	...	...	...	...	...	...	8.5	18.5	...	11.5	9.2	18.5	31.2	...	...	...	.6	...	...	...	...	...	...	2.3	...	...	No record.	Plate test. Good results.
41-A.C.	...	...	...	...	...	...	...	...	...	9.1	48.5	...	7.5	1.5	...	21.2	...	...	...	...	...	...	...	9.1	...	3.3	...	...	...	June 4, 1907, to Oct. 10, 1907.	Plate test. A few small blisters. No grass. No barnacles.
42-A.F.	...	...	...	...	...	...	...	2.7	...	8.2	22.0	...	6.8	7.0	22.0	19.2	...	...	...	...	...	...	...	8.2	...	8.2	...	...	...		
43-A.C.	1.4	...	...	...	...	...	...	...	...	11.4	1.1	...	2.1	5.0	34.2	33.2	...	...	...	...	...	...	...	...	...	5.7	...	5.7	...	June 8, 1907, to Oct. 10, 1907.	Plate test. A few small rust cones. No grass. Very few barnacles.
44-A.F.	1.2	...	...	...	...	...	...	3.7	...	10.0	.9	...	1.9	4.3	29.7	29.1	...	...	...	...	...	...	9.3	...	...	5.0	...	5.0	...		
45-A.C.	1.3	...	...	...	...	...	...	...	...	11.0	1.0	...	2.1	5.5	33.0	32.2	...	...	...	...	...	...	...	2.8	...	5.5	...	5.5	...	....	Plate lost overboard.
46-A.F.	1.3	...	...	...	...	...	...	2.5	...	10.0	0.9	...	2.0	5.0	30.0	29.8	...	...	...	...	...	...	7.9	...	...	5.0	...	5.0	...		
47-A.C.	...	...	...	...	...	...	...	...	...	11.6	...	...	...	5.7	34.8	11.3	...	...	...	...	...	...	21.0	...	...	...	...	...	15.3	June 14, 1907, to Oct. 10, 1907.	Plate test. Few small blisters. No grass. Very few barnacles.
48-A.F.	...	...	...	...	...	...	...	4.1	...	8.3	...	...	...	7.5	24.8	14.0	...	...	...	...	...	...	15.0	...	...	4.1	...	...	22.5		
49-A.C.	...	...	...	...	...	...	...	...	...	8.7	23.2	...	6.2	5.7	...	38.9	...	...	11.5	...	...	...	...	...	...	...	...	5.7	...	June 26, 1907, to Oct. 10, 1907.	Plate test. Few small blisters. No grass or barnacles. Results very good.
50-A.F.	...	...	...	...	...	...	...	...	...	17.1	...	...	9.2	...	34.2	28.8	...	...	...	2.1	...	...	...	...	...	...	...	8.5	...		
51-A.F.	...	...	...	...	...	...	...	1.4	...	13.7	18.4	18.4	9.2	6.4	...	31.2	...	...	...	1.0	...	...	...	...	...	...	...	...	...	No record.	Tested on bottom coal barge. Film cracked, blistered and fouled.

commandant of the Navy Yard at Norfolk and Captain Robert Stocker, C.C., U.S.N., the naval constructor.

By October 10, 1902, a plant had been established which could produce 208 gallons of ship's bottom paint per day. This amount was considered sufficient to paint all of the Navy vessels every six months, including those at that time being built.

When starting to develop formulæ for bottom paints very little technical information was available. Scientists and technologists had not published any data, so far as could be learned, and practically all data that had been compiled was held by persons engaged in the manufacture of bottom paints. Even at the present time there is very little published on the subject, scientific data which are available being confined largely to a classification of the various species of organisms which make up the fouling on ship's bottoms and to the life history, tendencies, reproduction, etc., of the various species. Dr. A. W. Bray, of the University of Iowa, has recently contributed valuable information on the relative effects of various toxic mediums on various species (his tests being laboratory tests) but it remains for some one to reproduce those mediums on the surface of submerged steel in such a way that the medium will be maintained for six months or longer.

European navies, with two or three exceptions, use commercial brands of paints and, so far as can be learned, in these exceptions varnish paints are used. Such data as I have been able to obtain from these sources are of little technical value as my tests along the lines suggested by the data give negative results in most cases.

Most of the data available from sources outside of the Navy consists largely of records of submersion tests comparing one commercial paint with another commercial paint, very little, if any, information being given about the formulæ. Such tests are usually so limited that the results can be accepted as only indicating and not proving.

With such scant information it was necessary, in starting tests to develop Navy formulæ, to try many combinations and through a process of substitutions, eliminations and alterations finally arrive at formulæ which would produce satisfactory paints.

The problem was to prevent rust and at the same time prevent fouling. Throughout the history of ship bottom paints the thought has been carried that two kinds of paint were necessary, one applied next to the steel to prevent rust, the other applied over the first paint to prevent fouling. (The writer is of the opinion that this is not necessary and that one paint should prevent both rust and fouling. This is shown to be possible by tests of a combination paint described later.)

To prevent rust it is necessary to have either an absolute waterproof film or a film containing that which will prevent rust even though the film is not waterproof. Films that are considered waterproof when applied to surfaces exposed only to air and the action of rain generally deteriorate rapidly under sea water. Granting, however, that an absolute waterproof film could be produced on a ship's bottom, the liability to damage of the film by anchor chains and floating objects is too great to warrant dependence upon waterproofness for preventing corrosion. It was therefore desirable to produce a film which contained that property for preventing corrosion even though water passed through it.

To prevent fouling the film must be toxic or repellent to all forms of fouling which infest the waters traversed by the vessel. Some of this fouling is of the animal kingdom, the most common forms being hydroids, worms and crustacea (barnacles). Some belong to the vegetable kingdom, the most common being algæ or grass.

The anti-fouling film must not contain an ingredient or ingredients which counteract with an ingredient or ingredients in the anti-corrosive film, or vice versa. The paint film must also stand alternate exposure to air and to submerged conditions and both paints must be of such a nature that they may be applied rapidly and will "dry" rapidly.

The First Experimental Paints Produced by the United States Navy

These last named conditions are so desirable that in the beginning of the tests to develop suitable Navy formulæ attention was given solely to spirit varnish paints.

Twenty-one different combinations were used to produce anti-corrosive and anti-fouling paints, the tests of which began in June, 1906. Later thirty additional formulæ were tried. These formulæ are shown in Tables I and II, together with a brief summary of results. The tests were first made on steel plates submerged at the Navy Yard and on the bottoms of yard craft.

The various anti-corrosive paints were used with the various anti-fouling paints at the same time using commercial paints (such as had been extensively used by the Navy) as bases for comparisons. By October, 1907, the tests had progressed sufficiently to indicate clearly the merits of formula number 17 for anti-corrosive paint and formula number 19 for anti-fouling paint as exceeding those of any other formulæ and greatly exceeding the merits of the commercial paints used as bases for comparisons. Here it may be stated that this stage of the development was reached in considering only the first twenty-one formulæ shown in Table I.

The tests of the other thirty formulæ followed. These thirty formulæ are interesting in that some of them show quite a marked departure from a straight spirits varnish paint and contain hard gum varnishes, waxes and various toxines, used both singly or in combinations. While the record of these tests indicates merit in some cases it appears that the paints giving excellent results were not followed up and no departure from formulæ 17 and 19 resulted.

Comparison With Commercial Paints

During the next four years the experiments consisted of painting Navy vessels at various Navy Yards with paints made from formulæ 17 and 19 and with commercial paints to get comparisons on all types of vessels as to relative merit, costs of application, spreading rates, etc. These tests were usually made by quartering the bottoms, applying the commercial paints to diagonally opposite quarters and the Navy paints to the remaining quarters. Typical of these tests were those made on the U. S. S. *Kearsarge, Illinois, New Jersey, Virginia* and *Rhode Island,* the bottoms of which were examined at the Navy Yard, Puget Sound, Washington. The report made on July 8, 1908, was favorable to the Norfolk test paints (numbers 17 and 19). They prevented fouling better than a well-known commercial paint and gave results as to rust and fouling prevention equal to another well-known commercial paint, and were easier to apply. The Navy Yard, Boston, Mass., found that the Norfolk anti-corrosive paint had a slightly higher and the Norfolk anti-fouling an appreciably lower spreading rate than a commercial brand of bottom paints that had previously been used extensively. The Norfolk Yard found the following spreading rates using the same kinds of paints as were used by the Boston Yard:

Norfolk anti-corrosive paint 26 square yards per gallon.
Commercial anti-corrosive paint 26.3 square yards per gallon.
Norfolk anti-fouling paint 24 square yards per gallon.
Commercial anti-fouling paint 24.9 square yards per gallon.

The use of commercial paints on Navy vessels continued throughout this period of experiments. The approved list of brands of commercial paints in 1908 included the products of four manufacturers but in March, 1910, the Norfolk yard had on hand ten brands of anti-corrosive and seven brands of anti-fouling paints in addition to the experimental paints.

(*To be continued*)

Automatic Water Level Adjusting Device for Boilers

It has long been well known by operating engineers that if the water level in a boiler is maintained at its most economical fixed height a great saving in fuel results. Keeping the water level constant by hand regulation is practically impossible, so to obtain the desired result the White Fuel Oil Engineering Corporation, New York, has developed the Todd Thermofeed regulator which, it is claimed, will maintain the water level to within 1/8 inch (watertube boilers 1/4 inch).

The device has but one mechanically actuated valve and depends for its operation on the water level fluctuations. The accompanying sectional views of the regulator and valve illustrate the action of the valve between its two seats and the float action. The valve and seats constitute a single unit which is attached to the top part of a stem reaching from toggles in the float chamber to the top of a valve spindle.

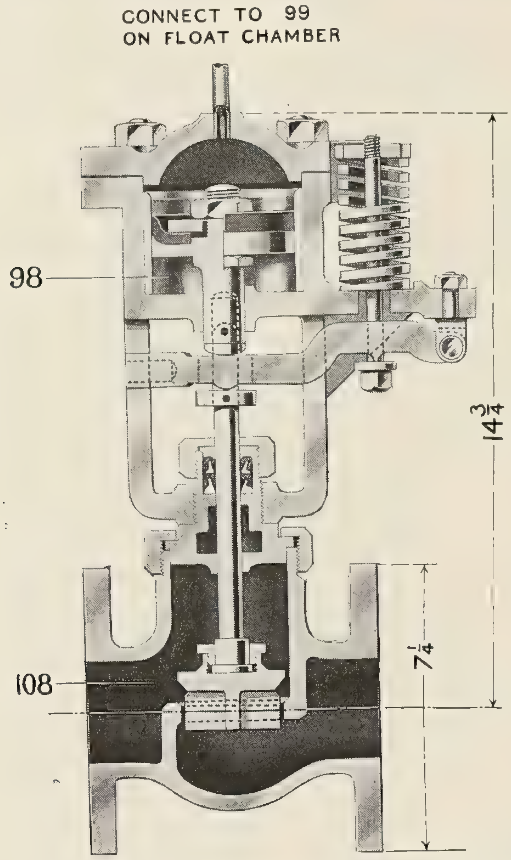


Fig. 1.—Sectional View of Todd Thermofeed Regulating Valve

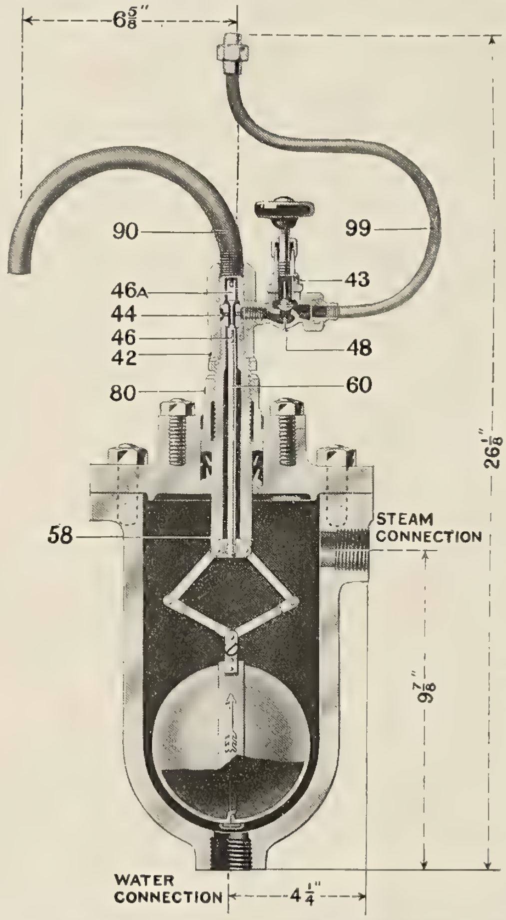


Fig. 2.—Sectional View of the Todd Thermofeed Regulator

The valve and seats together can be removed for examination, cleaning or renewal. The float, which is the only other moving mechanism in the regulator, consists of an electrolytically and hermetically sealed spun copper ball. The float is connected to the regulator feed valve through a 1/4-inch pipe. By shutting off the steam and water valves it is possible to take the whole of the Thermofeed mechanism apart.

Practically the entire function of the regulator is controlled through the three-way valve, marked 43, in Fig. 2. This is a double valve which, when it is on the outer seat in the pipe, allows the cylinder marked 98 in Fig. 1 to be put in communication with the control valve 46 in Fig. 2. When the valve is on the inner seat the cylinder is opened to the atmosphere which puts the Thermofeed out of action. The double seated controlling valve 46 performs the main function of the apparatus and is attached by a rod, 60, to the float through toggle levers so disposed as to reverse the direction of motion. Any movement of the float is diminished in the ratio of 10 to 1 as transmitted through the toggles and the rod 60 to the valve 46. If the water level and the float fall, valve 46 is raised upwards to the lower seat, closing any exit of steam through this valve and simultaneously putting the cylinder 98 in direct communication to the atmosphere by way of ports in 44 and exhaust pipe 90.

If the water level and the float rise, valve 46 is pulled downwards on its upper seat thereby permitting the passage of steam through the lower valve on to the piston in the cylinder 98, in this way gradually depressing the main regulating valve 108 on to its seat.

The entire controlling mechanism in the float chamber is attached to sleeve 58 and can be raised or lowered by the adjusting nut, 80, even when the device is in action. This provides a fine adjustment of the desired permanent water level.

International Chamber of Commerce to Convene in Rome

Several hundred representative American business men will attend the second general meeting of the International Chamber of Commerce to be held in Rome during the week of March 19, 1923, according to an announcement made recently by the American Section of the Chamber. The meeting will bring together leading business men from all over the world for a discussion of world trade problems. Sixteen countries affiliated with the International Chamber will send delegates, while several other countries which have made application for admission to membership in the Chamber will be represented.

Insulating Materials for Shipbuilding Purposes

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

INSULATING materials of interest in the shipbuilding field are those which insulate against heat, electricity and sound. The first mentioned has two main purposes—to keep useful heat where it will be of greatest value and to keep useful or useless heat from where it would be a detriment. The latter, when not in connection with refrigerating equipment, will be called for convenience of reference Miscellaneous Heat Resisting Insulation. Materials which on account of the high temperatures dealt with are selected more for their refractory properties than for their insulating properties will be classified as Refractory Materials. Electrical insulation is a specialty that is not usually dealt with independently by the shipbuilder and will be only briefly considered.

The principal manufacturers of all of the more important insulating materials have prepared detailed specifications covering their particular fields of usefulness and the best methods of applying them and these specifications will be found to be of great value when dealing with these materials. The manufacturers also give heat transmission and weight data.

Figures of the heat transmission or the heat conductivity of insulating materials, given by manufacturers or others, should be examined to determine which of the two is referred to and how the figures were obtained, because in some cases they are very misleading. Insulating materials offer resistance to the passage of heat through them from one surface to the other and there is a further resistance to the passage of the heat from the surface of the material to the air. The latter is practically uniform with different materials and for a single surface has been found by the Bureau of Standards to amount to 2/10 inch of corkboard or other good insulating material, as a maximum, for interior conditions with quiet air. It is negligible between surfaces of different materials built up in layers. Heat conductivity figures show by inversion the resistance of the material itself and heat transmission figures show both the resistance of the material and the surface resistance.

In the usual shipboard installations the insulating material neither stands alone by itself nor is there a wide air space on each side of it. With flat surfaces there are always external layers of wood or other materials and with pipe coverings there is the pipe on one side and a jacket or other coating on the other. So it is manifest that a comparison of the materials should be upon the basis of their actual internal thermal conductivity and not on the basis of transmission from air on one side to air on the other.

In some cases heat transmission figures are determined by accurate test for a 1-inch thickness of a material and then divided by two to obtain the value of the 2-inch material and so on. The results are necessarily erroneous and unduly favorable to the thicker material.

Tests of insulating materials made by the Bureau of Standards are on the basis of actual internal conductivity. The conductivities of a number of materials tested by them, together with their weights, will be found later on in the article in Table I. Some of these materials are not strictly insulating materials. Tables II and III give transmission or conductivity figures obtained from several sources for the materials principally dealt with in this article and they have some value, if used with discretion and checked up with Table I. The conductivities of some materials increase slowly with increasing temperature while others decrease slowly.

Generally speaking, the less dense a material is the more opposition it offers to the passage of heat. Air would be the best non-conductor of heat, aside from a vacuum, if it were not for the heat conveyed through it by radiation and convection, the former with small temperature differences being by far the principal reason why air spaces are not good insulators. A vacuum bounded by ordinary building materials has been found by the Bureau of Standards to have an insulating value less than ½ inch of corkboard. With air present this will be still lower and for widths greater than one inch will be practically independent of the width of the space, as the radiation factor, which constitutes the greater part of the heat transfer, is independent of the width. The radiation can be cut down to a large extent by running an insulating material through the air space. Convection can be prevented only by dividing the air up into small non-contiguous spaces. Insulating materials derive their efficiency chiefly from the multitude of small entrapped air spaces they contain; the smaller these are, the better.

The principal factors governing the selection of any insulating materials are:

Insulating efficiency.
Durability.
Ease of application.
Non-combustible properties.
Weight.
Cost.

Waterproof qualities are desirable as water adversely affects the efficiency and in most cases the durability.

For insulation of accommodations vermin proof properties are highly desirable.

For high temperature work the material should stand up without fusing or excessive shrinkage.

Refrigerating insulation materials must be odorless and of a nature not to develop odors from decay, mold or other causes.

Structural strength and appearance are factors in some cases.

There are many materials which might be used for insulating purposes on shipboard that are not here dealt with. Some of them will be found listed in Table I. The article, however, deals with the more important of the materials and those in most general use.

Insulation on boilers, pipe fittings and other work which requires to be tested should not be put on until these tests have been made and the work approved by the inspectors concerned.

Refractory Materials

The most used refractory materials are fire brick and fire clay, the latter being required for filling up the joints in the former. Fire brick tile and other materials of the requisite heat resisting properties are on the market and are used to some extent.

Refractory materials are required for lining the steel cas-

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

ings of watertube boilers and similar service. They assist in keeping the furnace at a high temperature and in diffusing the heat.

Fire Brick

In preparing requisitions for fire brick it is usually necessary only to list the sizes required and to specify—

1. That they shall be high grade commercial quality, suitable for coal or oil burning furnaces. Fire brick in an oil burning furnace should be able to stand a heat of 3,200 degrees F. without fusing or cracking.
2. That they shall have a medium, uniform grain and all surfaces shall be reasonably true and free from warpage.
3. That on dimensions of 4 inches or over, they shall not vary more than ¼ inch per linear foot from the specified dimensions. On dimensions under 4 inches they shall not vary more than ⅛ inch per linear foot from the specified dimensions.

The last two items are requirements of the Navy Department, which also requires the trade name or the name of the manufacturer to be molded in each brick and calls for a minimum softening temperature of 3,100 degrees F. and the following chemical properties:

	Percent
Silicon dioxide (approximately)	54
Aluminum oxide (approximately)	41
Basic fluxes as K, Na, Mg, Ca, Fe. determined as oxides (approximately)	5

If the heat and spall resisting properties of the make of fire brick dealt with are not known, and known to be uniform, it is well to request a statement of the guaranteed minimum softening temperature and a chemical analysis of the bricks proposed, showing the percentage of silicon dioxide, aluminum oxide and the basic fluxes, iron, calcium, magnesium, potassium and sodium oxides.

The American Society for Testing Materials has adopted a Standard Specification, C27-20, for determining the properties of fire brick. This specification deals with fire clay bricks with silica content less than 70 percent and silicious clay fire bricks whose silica content is 70 percent or over. The former are required to have a softening point not less than that of a standard cone which softens at about 3,065 degrees F. as determined in a specified manner; and when heated in a suitable furnace to a temperature of 2,552 degrees F. maintained at this temperature for 5 hours, and cooled, they are required to show a contraction of not over 1½ percent of the original length nor an expansion of more than 1 percent. For the silicious clay bricks the softening point is to be not less than that of a standard cone which softens at about 2,975 degrees F., the contraction and expansion being as above; and they must also be subjected to a load test when heated, in accordance with a Standard Test for Refractory Materials, C16-20, with a pressure on the ends of 25 pounds per square inch and a maximum furnace temperature of 2,462 degrees F., after which the brick is to show a contraction of not over 4 percent of the original length and an expansion of not over 1 percent. Bricks with less than 70 percent silica content which soften at a temperature less than that specified above but more than the softening point of a standard cone which softens at about 3,002 degrees F., may still be accepted, if they are put through and pass the tests required, as outlined above, for the bricks with 70 percent silica or over.

Fire Clay

Fire clay should be specified to be high grade and to be dry and ground to such fineness that it will all pass through a No. 20 sieve. Information about sieves will be found in the article on Cement and Concrete for Shipbuilding Purposes.* The Navy Department calls for the same chemical properties as for fire brick and a minimum softening temperature of 3,000 degrees F.

*See Marine Engineering and Shipping Age, May, 1922, page 331.

High Temperature Cements

These take the place of fire clay in bonding fire bricks and such cements should be used rather than fire clay in oil burning furnaces. They can be obtained in various grades to suit different temperature ranges, such as 1,800 to 2,500 degrees, 2,500 to 3,000 degrees, 3,000 to 3,200 degrees, and 3,200 degrees and over. They require a certain temperature to properly flux them and the manufacturer should be informed regarding any set of conditions. The cement should protrude from the joint and be rounded over to protect the corners of the fire bricks.

A suitable high temperature cement thinned down with water so as to form a mixture that can be applied with a brush forms a valuable wash for grouting over the inner surface of furnace linings. Flux mixtures containing silicate of soda, salt, broken glass, etc., should not be used to produce a glaze. Silicate of soda affects the bricks chemically and eventually destroys the lining.

High temperature cement can be mixed up with crushed fire brick to make lining for furnace doors, patches, etc.

Heat Retaining Insulation

Diatomaceous Earth (Kieselguhr)

This is practically pure silica in cellular form, made up of minute shells or skeletons of marine plants known as diatoms which existed ages ago in the waters that then covered the earth. The shells are hollow and contain air broken up into such minute particles that no circulation, with its attendant convection of heat, can take place.

Insulating bricks of which diatomaceous earth is the principal ingredient have about ten times the heat insulating value of fire brick. They are of great value for backing up fire brick in boiler furnaces and similar service. They have too little abrasion resistance for anything but backing. Several proprietary products of this kind are on the market, such as Sil-o-cel bricks and Nonpareil insulating bricks. These bricks are very light weight. The standard size Sil-o-cel brick, 9 inches by 4½ inches by 2½ inches, weighs 1¾ pounds. The standard size Nonpareil brick, 9 inches by 4½ inches by 2½ inches, weighs 1½ pounds. In making the latter bricks the diatomaceous earth is pulverized and mixed with finely ground cork, which is subsequently burned out.

Diatomaceous Earth and Asbestos

Diatomaceous earth mixed with asbestos and compressed forms a suitable covering or lagging for boilers, steam pipes, feed water heaters, evaporators, etc. Thicknesses used are the same as for 85 percent magnesia.

The standard sectional pipe covering is obtainable. Valves and fittings are covered with plastic cement of the same material and thickness.

It is desirable to specify that the insulating qualities shall be equal to those of the best quality 85 percent magnesia covering.

Eighty-five Percent Magnesia

This is the standard covering for the steam and water containing surfaces of boilers and for uptakes, feed water heaters, evaporators, pressure steam pipes and similar services and also for lagging turbines and the cylinders of main engines. It is of course of value for less severe service but in some cases cheaper coverings will answer the purpose. It is very efficient for a high heat material, durable, easily handled and of light weight. Wetting does not damage it and on being dried its insulating value is restored. It is a mixture of hydrated carbonate of magnesia and asbestos fiber, containing at least 85 percent of the former and at least 95 percent of both combined. Specifications for coverings of this material, prepared by the Magnesia Association of America, specify the following thicknesses as representing

good practice for conditions which approximate those on shipboard; and they give charts and tables for determining scientifically correct thicknesses for variations in the determining factors—fuel cost, steam pressure and superheat:

Boilers and uptakes.....................................3 inches total
Donkey boilers ....2 inches total
Pipes—superheated-steam—½ inch to 1½ inches, inclusive......1¾ inches
  2 inches to 3½ inches, inclusive..........................2 1/16 inches
  4 inches and larger....3 inches (double layer), and ½-inch "85% magnesia" plastic cement.
Pipes—high pressure saturated steam, up to 4 inches..............2 inches
  4 inches to 6 inches, inclusive..........................2¼ inches
  7 inches to 10 inches, inclusive..........................2½ inches
Pipes—low pressure steam, exhaust steam, heating system, feed water:
  ½ inch to 1½ inches, inclusive..........................⅞ inch
  2 inches to 3½ inches, inclusive......................1 1/32 inches
  4 inches to 6 inches, inclusive..........................1⅛ inches
  7 inches to 10 inches, inclusive..........................1¼ inches
  12 inches and larger..................................1½ inches
Flanges—superheated steam and high pressure saturated steam......2 inches
  low pressure steam, exhaust steam and heating system......1 inch
Heaters, receivers, separators, tanks, etc—high pressure steam..3 inches total
  low pressure steam..................................2 inches total
  hot water ....1½ inches total
Traps—high pressure ....1½ inches total
  low pressure ....1 inch total

For piping the usual sectional covering in two halves is used, either in a single or double layer, 36-inch sections. When two layers are used they should be applied with the butt and lateral joints broken. The sections are furnished with a so-called canvas jacket pasted on and supplied with bands or wires for fastening; but it is generally desirable to apply rosin sized sheathing paper over the jacket followed by an additional jacket, well sewed on, of 8-ounce canvas as described in the article on Canvas, Bunting and Felt for Shipbuilding Purposes*, the canvas being subsequently painted. Such a waterproof covering is essential on piping to deck machinery and other exposed piping.

Block material on boilers, evaporators, etc., is securely wired in place, covered with galvanized iron wire mesh and then with ¼ to ½ inch of hard finishing asbestos cement troweled to a hard, smooth finish, or with galvanized steel plates. Block material on engine cylinders and similar service is usually held in place and covered by planished iron plates.

For boilers and steam drums No. 14 gage annealed iron wire and 2-inch mesh poultry wire are advisable, while for evaporators and similar service the wire can be No. 18 gage with 1½-inch mesh poultry wire.

The 85 percent magnesia cement covering may also be applied as a cement. This is sometimes desirable on irregular surfaces, but the blocks or sectional coverings are generally preferable.

Asbestos Felt

Asbestos is a mineral fiber and asbestos felt is the pure fiber felted or built up in layers. It is often called fire felt. It can be obtained in rolls from 3/32 to ⅜ inch thick and in sheets from ⅛ inch to 1 inch thick.

It is not as efficient as the 85 percent magnesia covering but is more resistant to vibration. It is decay proof and highly fire resistant. It is frequently used for lining fire doors of boilers and similar service; also for lagging the cylinders of small steam engines, the steam ends of pumps, etc. The flexible sheets are used for a great variety of purposes where there is need for a material that may be folded, bent or wrapped around pipes and heated surfaces.

Sponge Felted Asbestos

This is composed of thin layers of asbestos felt in which are embedded particles of finely ground spongy material, built up in blocks in thicknesses from ½ inch to 4 inches and in sectional pipe covering in thicknesses from ½ inch to 3 inches. Valves and fittings are covered with asbestos cement of the same thickness.

Sponge felted asbestos has the high insulating properties of the 85 percent magnesia covering combined with the resistance to vibration of asbestos felt.

It is desirable to specify that the insulating qualities shall be equal to those of the best quality 85 percent magnesia covering.

Asbestos Paper Products

Asbestos paper is a pulped material made almost entirely of asbestos fiber but having more filler than asbestos felt. It can be obtained in thicknesses from about 1/100 inch to ⅛ inch. The 3/32 and ⅛ inch thicknesses are spoken of as rollboard.

The principal field for asbestos paper as a heat retaining insulation is when it is made up into blocks and pipe covering in various ways. Generally flat sheets and indented or corrugated sheets are cemented together alternately. One make has the sheets separated by narrow strips of the same material. Some of these coverings approach closely in insulating value the 85 percent magnesia covering. A covering of this nature is tougher than the magnesia covering. As the insulating value is largely the result of the air cells formed by the indentations, corrugations, etc., the cheaper grades of this covering are often called air cell covering. In order to avoid the losses due to the heated air traveling along the corrugations, one manufacturer for some years marketed a covering with the corrugations running around the pipe. He found, however, that the trade would not pay the extra cost of the more efficient covering and has brought out a substitute covering with the longitudinal corrugations interrupted at intervals. This can be produced at practically the same cost as with the corrugations forming open channels from end to end. As may be seen from Table II, the air cell covering loses efficiency more rapidly at the high temperature ranges than the other coverings.

In some cases the asbestos paper coverings are more desirable than the 85 percent magnesia covering. An asbestos covering is more durable on vibrating pipes; and the relatively high cost of the latter covering is often not warranted on exhaust steam pipes, heating system pipes, feed water pipes and warm air ducts, where comparatively small temperature differences are met with. The better grades are considerably heavier than the 85 percent magnesia covering but the air cell coverings are of less weight.

Asbestos Blocks

The asbestos fiber matted into blocks and bound together with a fireproof adhesive, or layers of asbestos felt cemented together, forms a covering with good insulating efficiency and great resistance to high temperatures. It may be considered next to 85 percent magnesia for use on uptakes.

Asbestos blocks are suitable for lagging engine cylinders and similar service and in such service are protected by planished iron or other metal covering.

Some high temperature block coverings for special service have refractory materials mixed with the asbestos.

Asbestos Millboard

This is composed of asbestos fiber with a very small percentage of binding or sizing material and can be obtained in sheets from 1/16 to ½ inch thick. There are three standard grades—a hard compact board due to closely matted fiber, a board of medium consistency and a soft board due to loosely matted fiber. The two former are most met with on shipboard.

The Navy Department has prepared detail specifications for this material. Its requirements that are the most valuable for general application are:

1. Boards of uniform thickness, composed of asbestos fiber with a small amount of binding material.
2. Vegetable matter shall not exceed 3 percent by weight of the composition of the millboard and the same shall only be used as sizing.

*See Marine Engineering and Shipping Age, February, 1922, page 131.

3. Millboard shall show no change of texture and no softening when heated indefinitely in a dry heat at 400 degrees F.

4. The loss of weight of millboard after it has been dried to a constant weight at a temperature not exceeding 220 degrees F., shall not exceed 20 percent when a 2-gram sample is cut up and heated to a bright cherry red heat, in an open crucible in a gas muffle for 30 minutes.

5. The maximum acceptable weights for millboard reduced to the basis of 1 square foot area, 1 inch thick, shall be:

Medium millboard .... 6.00 pounds.
Hard millboard .... 6.50 pounds.

Asbestos millboard 1/4 inch to 3/8 inch thick is sometimes used back of fire brick in boiler furnaces. It is of value for lining casing doors and headers and similar service.

Hair Felt

Hair felt insulation is principally used for refrigerating and sound proofing purposes and the nature of the material will be found described under the former heading. It has good insulating value but will not stand high temperatures. It is often used for covering hot water piping.

Wool Felt

Wool felt, which is simply felted sheep's wool, has good insulating value at moderate temperatures. It will not stand high temperatures and after being exposed to dampness it loses its efficiency and eventually decays. With the outside waterproofed and all joints sealed so that water cannot gather in it, such a covering is of value for hot water pipes and similar moderate temperature service.

Wool felt covering for hot water lines has an inner core of asbestos paper.

Mineral Wool

Mineral wool insulation is used principally for refrigeration purposes and the material will be dealt with more fully under that head. It may, however, be well to note that it has been made up into thick sheets and blocks with about one-third of one percent of binder, for use as heat retaining insulation. Such a product is suitable for low pressure work on boilers and piping.

Vegetable Fiber Products

There are many proprietary insulating products of this nature and some of them have been found to fulfill shipboard requirements as heat retaining insulation for spaces where the useful heat has to be conserved, such as in the accommodations of vessels not propelled by steam. Any of them which may be presented for consideration can be readily examined for everything except durability and the character of the ingredients is a good guide to that.

One of these products is a quilt insulation called Linofelt that is made of flax fibers which have been degummed and retted and formed into a batlike cotton batting, and quilted between two sheets of waterproof paper. It can be obtained in 1/4 inch, 1/2 inch, 3/4 inch and 1 inch thicknesses. The 1 inch thickness weighs 0.66 pound per square foot. The thinner products are somewhat heavier in proportion. It is claimed to be mouse and vermin proof.

Another product is Fibrofelt, a semi-rigid material made from hemp fiber and containing a large number of air cells. It can be furnished in large sheets 1/4 inch, 1/2 inch, 3/4 inch and 1 inch thick. The 1 inch thickness weighs 1 1/4 pounds per square foot. In addition to the ordinary grade there is also a waterproof Fibrofelt and a fireproof Fibrofelt. It is claimed to be mouse and vermin proof.

Another product, Flaxlinum, much resembles Fibrofelt but is made from flax fiber which has been rendered rat and vermin proof. It comes in sheets 1/2 inch and 1 inch thick.

Cabot's Quilt is another product suitable for joinerwork heat retaining insulation. It is a felted matting of cured eel-grass stitched between two layers of tough Kraft paper, waterproof paper, or asbestos paper, as desired. It is light in weight, repels mice and vermin and is claimed to be decay proof and uninjured by moisture. The Kraft paper grade is made single-ply about 1/3 inch thick, double-ply about 1/2 inch thick and triple-ply about 3/4 inch thick. The other two grades are of the double-ply thickness.

There are various products made up like wood boards, of materials which have some insulating value, but their properties do not particularly recommend them for this service.

Insulating Paper

Insulating paper might be classed with the other vegetable fiber products but its wide range of service both independently and combined with other insulating materials entitles it to special classification. The best insulating paper is a waterproof paper containing jute, flax and rope stock, saturated and coated with asphalt, which weighs 80 pounds or more per 1,000 square feet, and this weight should be specified as a minimum. It comes in rolls of various widths, the usual width for insulating work being 36 inches.

Refrigerating Insulation

It is especially important with refrigerating insulation that it be efficient and durable in case of becoming wet. It should be sanitary and odorless. Non-combustible properties are not as important as for heat retaining insulation.

A good efficiency requirement for a completed refrigerated compartment installation is that after operating the refrigerating plant for a reasonable time it is to be shut down and the temperature is not to subsequently rise over 1 degree per hour, based on an outside temperature of 90 degrees.

Cork is the principal material for use as refrigerating insulation on shipboard including pipe covering. Balsa wood has been used to some extent for this service. For curved surfaces and surfaces broken up by framing, such as the sides of a vessel, the hold bulkheads and the underside of steel deck over refrigerated holds, mineral wool is considerably used.

Sheet or formed material should be used where conditions permit. It is impossible to make loose insulating materials moisture proof; they are bound to settle leaving unprotected spaces and, if a break occurs in the retaining sheathing, they will run out, with the same result.

All insulation in refrigerated rooms requires an inner sheathing of some kind and where this is wood the wood is preferably spruce on account of its freedom from odor and consequent tainting of the foodstuffs. For the same reason asphalt that is entirely free from odor, and not tar or pitch, should be employed when erecting the insulation of such spaces.

Where a ship is classed, the insulation of refrigerated spaces has to be passed upon by and be acceptable to the classification society concerned.

Corkboard

This is the standard refrigerating insulation for use in partitions, on decks and other flat or nearly flat surfaces. It is also used on curved surfaces in conjunction with a packing of granulated cork or other material. Dried cork in its natural state contains 47 percent of woody fiber and 53 percent of entrapped air.

The most efficient grade of corkboard consists of pure granulated cork compressed in metal molds and baked at a moderate temperature. The baking process brings out the natural gum or rosin in the cork, binding the whole mass firmly together, and no artificial binder is necessary. It can be obtained in sheets 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/2, 2, 3, 4 and 6 inches thick; the standard size of sheet is 12 by 36 inches. It comes with an odorless asphalt mastic finish about 1/8 inch thick ironed on the surface at the factory. An average weight is about 7/8 pound per square foot for the 1 inch thickness and 1 5/8 pounds for the 2 inch thickness.

One maker of corkboard produces and claims superiority

for a product which contains 4.8 percent by volume and 16⅔ percent by weight of an odorless asphalt binder. The granulated cork is thoroughly dried and then coated with the asphalt at a high temperature. It is then molded into boards under no greater pressure than that necessary to make a close union of the particles. The boards measure 16⅝ inches by 34⅝ inches, or 4 square feet. This material weighs about 1½ pounds per square foot per inch of thickness. Superiority is claimed for this product on the ground that it has a greater weight of cork than other corkboard, that compressing the cork reduces its valuable air content and that burning the cork to break down the elasticity of the cells and make the compression permanent increases its susceptibility to moisture and adversely affects its durability. The greater weight of the product is, however, a detriment for shipboard service. The efficiency has been proved to be less than that of the pure corkboard and the latter stands up satisfactorily against moisture.

Other makes of corkboard with an asphalt binder are obtainable. Cheaper grades of corkboard made of granulated cork mixed with pitch, and probably also containing a certain amount of cork dust and dirt, are also on the market; but they are not desirable for shipboard installations. The pitch is particularly objectionable, as before mentioned.

The Navy Department specifications for corkboard require it to be pure, ground, compressed cork, held together by the natural cork gum as a binder; and they require further—

The cork shall be furnished in sheets 36 inches by 12 inches, in thicknesses of 1 inch, 1½ inches, 2 inches, or 3 inches, as specified. The weight per cubic foot shall be not less than 8 pounds nor more than 12 pounds.

Representative samples of the cork shall be submerged in boiling water at atmospheric pressure for three hours without disintegrating. Immediately upon removal from the boiling water, samples shall be measured for linear expansion, which shall not exceed 2 percent in any direction.

One of the manufacturers of this material recommends for average climatic and building construction conditions on land the following:

Temperature	Thickness
—20 to —5 degrees F.	8 inches.
— 5 to 5 degrees F.	6 inches.
5 to 20 degrees F.	5 inches.
20 to 35 degrees F.	4 inches.
35 to 45 degrees F.	3 inches.
45 degrees and above	2 inches.

This agrees pretty well with the usual shipboard practice.

Cork Pipe Covering

This is one of the most widely used cold pipe coverings. The most efficient quality is made by compressing and then baking pure granulated cork in molds of the proper size and shape to suit the pipes and fittings which are to be covered. The baking brings out the natural gum of the cork which binds the mass firmly together as before stated. As the compressed cork comes from the molds it is coated inside and out with a waterproof mineral rubber finish, ironed on hot. Cork pipe coverings can also be obtained made up with binding material as explained under the head of "corkboard"; and the surfaces are given a waterproof coating.

This covering can be obtained in sectional form to fit any standard pipe from ¼ inch to 8 inches, sections 36 inches long. Special shaped filling pieces are obtainable for use between pipes that are too close together, or back of pipes that are too close to other surfaces, for the standard covering. For pipes larger than 8 inches cork lagging is used. The thicknesses usually required are—

1. Standard brine covering, about 2½ inches thick, for brine and ammonia gas lines, and generally where the refrigerant ranges from 0 to 25 degrees F.
2. Special thick brine covering, about 3½ inches thick, for brine lines, where the temperature of the refrigerant runs below 0 degrees F.
3. Ice water covering, about 1½ inches thick, for use on refrigerated drinking water and liquid ammonia lines, and generally where temperatures of 25 to 45 degrees F. are carried.
4. Cold water covering, for pipes up to and including four inches, about 1 inch thick, for use on cold water piping to prevent sweating. For sizes larger than four inches, use ice water covering.

When calling for this pipe covering as a part of refrigerating apparatus specifications it is usually sufficient to stipulate that the refrigerating supply and return pipes will be lagged with best quality compressed cork of suitable thickness.

The complete covering requires—

1. A putty for filling any spaces that may exist between the covering and the pipes or fittings.
2. A waterproof cement for cementing the joints.
3. A seam filler for smoothing up seams and chipped edges.
4. Copper clad steel wire for holding the covering in place. Copper wire and galvanized wire have not been found satisfactory.
5. Asphaltic paint for coating the outside of the covering to give it a neat and trim appearance.

These materials are obtainable from the manufacturer of the covering.

Cork Lagging

This is of the same character as cork pipe covering, but is denser and more suitable for the insulation of coolers, tanks, filters, etc., than the regular corkboard. The pieces are beveled to the proper radius and have a mineral rubber finish on both the inner and outer surfaces, ironed on at the factory.

In order to guard against the use of the regular corkboard it is well to specify that the material be pure compressed cork and weigh not less than 1¼ pounds per board foot.

Cork lagging calls for the use of the same putty, cement, etc., as listed under the head of cork piping covering except that on brine coolers, tanks, etc., the lagging is usually held in place by iron bands about 1 inch wide, and No. 20 gage, which are drawn up tight by bolts through clips riveted to the ends of the bands.

Usual thicknesses are as follows:

Temperature	Thickness
Below 5 degrees F.	6 inches.
5 to 20 degrees F.	5 inches.
20 to 32 degrees F.	4 inches.
32 to 55 degrees F.	3 inches.
55 to 65 degrees F.	2 inches.
Above 65 degrees F.	1½ inches.

Granulated Cork

Granulated cork comes in several degrees of fineness. The standard grade for insulating purposes will all pass through a ½ inch mesh screen and weighs about 6½ pounds per cubic foot.

Granulated cork is of value for packing in back of corkboard or cork lagging on curved and irregular surfaces. It is used considerably for this purpose in the holds of refrigerated ships as well as when insulating brine coolers, dished heads of tanks, etc. It does not become waterlogged like most forms of loose insulating materials, but possesses their disadvantages in other respects.

Balsa Wood

The nature of this wood has been dealt with in the article on "Timbers and Lumber for Shipbuilding Purposes"* and its value as an insulating material has been there referred to. Its use for such purposes meets with classification society approval. It is a substitute for corkboard in the services mentioned for that material. It is also used in the construction of portable refrigerators. It is too soft to serve as a surface material but has sufficient strength to carry a limited load.

Balsa wood has to be protected from destruction by mois-

*See Marine Engineering and Shipping Age, October, 1921, page 771.

ture. This is accomplished by first steaming the planks in kilns and subjecting them to a subsequent process of slow evaporation until the moisture content is below 10 percent. In this condition the wood is transferred to cylinders where under the required temperature and pressure conditions it is encysted by a proprietary process. This process carries a waterproofing compound through the wood to varying depths, according to the extent of the treatment, coating the ducts and cell walls and preventing thereby access of moisture to the wood structure and destroying the capillarity of the ducts. The owners of this process recommend that the surface be given an additional bitumen waterproof coating when the wood is to be used for refrigerating insulation.

The above mentioned encysting process somewhat reduces the insulating value of the wood and adds to its weight. The following data regarding this were obtained by the Bureau of Standards as the result of a series of tests with a temperature difference of about 35 degrees F. at a mean temperature of about 85 degrees F. The first column shows the conductivity in British thermal units per 24 hours, per square foot of surface, per degree difference in temperature, per inch of thickness. The weight is in pounds per cubic foot.

	Conductivity	Weight
Light wood, untreated	8.3	7.4
Light wood, light treatment	7.8	8.8
Light wood, light treatment, shellaced	8.3	8.4
Light wood, bitumen coated	7.9	9.6
Light wood, medium treatment	8.6	11.8
Medium wood, untreated	9.2	8.9
Medium wood, light treatment	9.2	9.6
Medium wood, medium treatment	10.7	14.7
Medium wood, heavy treatment	12.9	16.8
Medium wood, very heavy treatment	21.6	41.6
Medium heavy wood, untreated	14.0	20.5
Medium heavy wood, light treatment	13.8	20.8

Although a considerable number of shipboard installations of Balsa wood as a refrigerating insulation have been made in recent years, the writer does not feel that they are sufficient in number or age to fully determine the durability of this material, even with thorough encysting.

As stated in the earlier paper, the cost of Balsa wood insulation may in some cases be expected to compare favorably with corkboard insulation; the weight is as above given and the combustible properties of the encysted wood are not much worse than the usual run of refrigerating insulating materials, with the exception of mineral wool.

(To be continued)

Self-Operating Water Circulator for Scotch Boilers

A NEW type of water circulator, known as the "Compulsoree," designed to pick up cold water from the bottom of the boiler and discharge it just above the working water level thus creating a positive circulation has been developed by N. E. McClelland and Company, Ltd., 2-4 Stone street, New York.

The circulator consists of a steel cylinder to which are affixed by electrical welding two cast steel heads, one at each end, the heads being constructed with lugs by means of which the instrument is secured in the boiler, and having openings to accommodate leads of piping. The assembled instrument is located in the Scotch type of boiler as shown in the diagram.

The "Compulsoree" operates on the principle of an air or steam lock, air being the actuating gas until as the water in the boiler gets hotter air is replaced by vapor.

During the process of filling the boiler, water rises in the suction leg of the instrument until a level is reached where the bend at the top of this leg is entirely submerged. At this moment, the water in the suction leg overflows into the enlarged chamber of the "Compulsoree" and falls by gravity to the bottom of the chamber. As the water drops into the chamber, it displaces an equivalent amount of air, but owing to the increased size of the chamber over the suction pipe it is impossible for a sufficient amount of water to fall into the chamber necessary to force out all the air. Therefore, a moment is very quickly reached where atmospheric pressure in the discharge leg, the end of which is at all times above water, plus the weight of water which has fallen into the chamber, will compress the air remaining in the chamber sufficient to prevent a further rise in the suction leg above

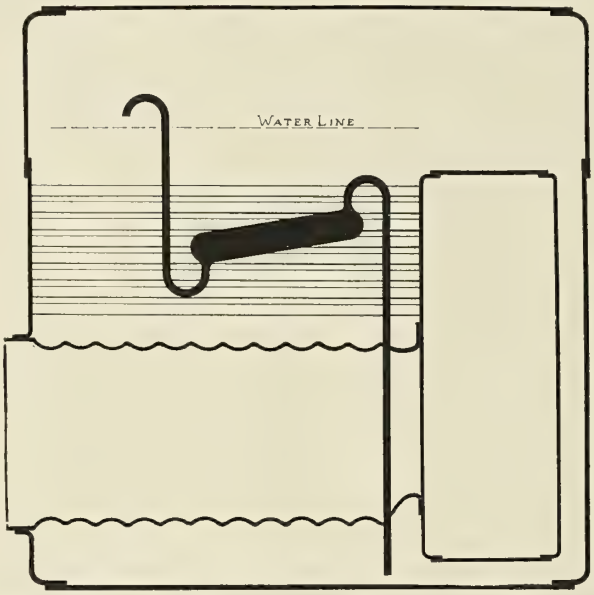


Diagram Showing Arrangement of "Compulsoree" Circulator Installed in Scotch Boiler

the level where it is held in check by the pressure as described.

An air lock is now formed between the column of water in the suction leg and the water which has accumulated in the chamber of the instrument.

When the process of filling the boiler to the required level is complete and the fires lighted, hot gases passing through the fire tubes impart heat to the "Compulsoree" chamber thereby causing the air imprisoned in the chamber to expand and force the water lying therein out through the discharge end along the line of least resistance. The chamber of the "Compulsoree" being now empty, water again rises in the suction leg and overflows into the chamber causing the whole process described above to be repeated. Following the first discharge of water the cycle of operation becomes continuous, cold water being picked up from the bottom of the boiler and discharged into the warmer water on top at the rate, it is claimed, of one gallon every four seconds.

The circulation created by the "Compulsoree" within the boiler is entirely independent of any outside influence as there are no connections on the outside of the boiler whatever. The instrument is constructed of high quality material with no valves or working parts to get out of order. It has been adopted by many of the leading steamship owners and railroad companies throughout the world.

Trial of Diesel Engined Yacht Cynthia

ON July 20 the yacht *Cynthia,* which was designed by Cox and Stevens, naval architects, New York, and built by the Tebo Yacht Basin Company of the Todd Shipyards Corporation, New York, was given an official trial. The *Cynthia* is 129 feet overall, 122 feet 3 inches on the load waterline, 23 feet beam and 6 feet 6 inches draft.

She is a twin screw vessel engined with two Winton 250 horsepower 4 cycle, 6 cylinder full Diesels which propel her at a speed of 12 knots.

The fuel storage capacity of the vessel is 30 tons which, at a guaranteed consumption of not over 0.4 pound per horsepower hour, is sufficient to carry her for a long time without refueling. Electricity is provided by one 5-kilowatt and one 7-kilowatt gasoline generating sets and also by a 100-cell Edison storage battery.

The engines gave a very satisfactory performance on the trial, running smoothly at various speeds. The accommodations for the owner and his guests are commodious and handsomely finished and the general appearance on deck gives one the impression of greater space than would be expected to be available on a yacht of this size.

Diesel Engined Lighter Shows Remarkable Economy in Operation as Compared with Steam Lighter

CONCRETE evidence of the savings possible with a Diesel engine driven harbor vessel is shown by the engine room log of the new motor lighter *Worthington,* described in our April issue. The boat has been in operation for several months so that it is now possible to judge the fuel economy of this method of propulsion. The value of these results is greatly enhanced by comparative figures taken from the records of the steam engined lighter *Daniel Webster,* previously operated by the Worthington Corporation.

An analysis of the Diesel lighter's movements and fuel consumption was made covering the month of April, 1922, with the following result:

300 horsepower main engine in operation..	75 hours 31 minutes
50 horsepower auxiliary engine in operation	105 hours 50 minutes
7 horsepower lighting set in operation....	35 hours 30 minutes
Total fuel used	1,616 gallons
Total cost of fuel used at 4 cents per gallon	$64.64

On a mileage basis the fuel cost during this month averaged 10 cents per mile. Small vessel owners will appreciate the significance of this figure.

While the preceding data are interesting from the standpoint of the fuel operating cost that has been realized in actual operation, the interest in these figures is heightened when the Diesel lighter is compared with the steam driven vessel. The following table gives comparative figures for the new Diesel lighter and the old steam lighter showing the comparative sizes, power and fuel cost:

	Steam Lighter	Diesel Lighter
Length, feet	131	133
Beam, feet	28	34
Hold, depth, feet	11	11¾
Gross tonnage	216	333
Derrick capacity in tons	12	20
Horsepower, main engine	175	300
Hours under way per month....	59 (average)	75½ (Apr. 1922)
One month's fuel cost in dollars (coal at $8 per ton)........	$410 (average)	$64.64

From this table it will be noted that while the Diesel lighter is larger both in point of tonnage and propelling power and while it was under way 75½ hours during one month, and the steam lighter averaged only 59 hours per month, still the Diesel lighter fuel cost was only slightly more than one-seventh as much as for the steam vessel. In other words, the Diesel lighter operated many more hours with an engine developing greater horsepower and used only a little over one-seventh as many dollars worth of fuel as the steam lighter. If the Diesel lighter figures are corrected to a 59 hour basis to conform to the average figures for the steam vessel, we then have $410 total cost in one case for 59 hours operation, as against $50.74 oil cost on the other. When the two figures of $410 and $50.74 per month are plotted, as in Fig. 1, the whole story of fuel cost for a year or any part of a year is shown at a glance. There are of course many savings supplementing the fuel economy which are effected by the Diesel drive that have been presented in other discussions on the subject, but in these directions, too, the Worthington lighter gives us concrete and definite facts.

The Diesel lighter log shows that she fueled on March 17 and on May 18, two months later, but still had 500 gallons of fuel oil aboard. Two months constant operation certainly means time and money saved and to this must be added the facts that the Diesel lighter spent no time out at the ash scow and no time at the water plug.

Any figures worked up on the basis of the foregoing data to show fuel consumption per horsepower per hour are apt

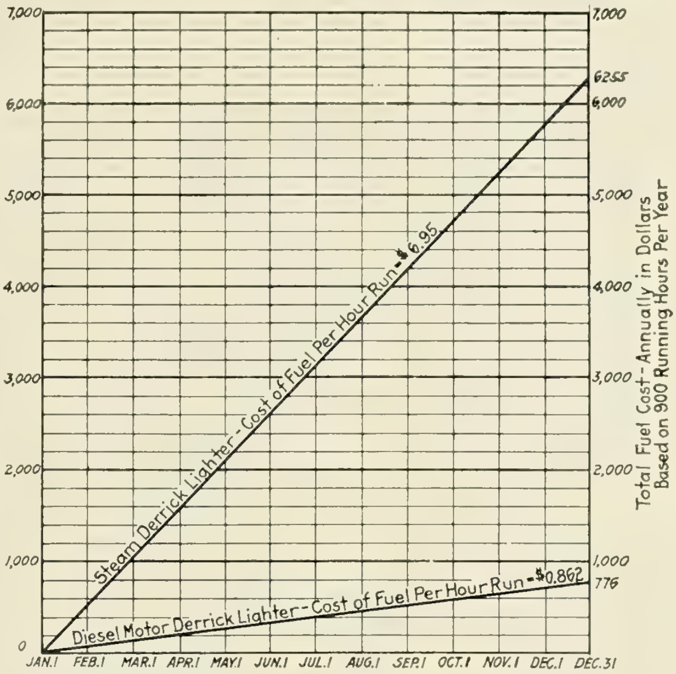


Fig. 1

to be misleading because of the conditions under which any lighter must operate. A lighter must go through too many maneuvers in plying about the harbor to make a guess as to the actual load on the engines at all reliable. For instance, the Worthington lighter's log shows that the main engine was started ahead or astern anywhere from 12 to 50 times at every pier landing during the month of April. It might be mentioned in passing that this is indeed a tribute to the flexibility of the Diesel engine and certifies to its reliability in maneuvering.

The lighter has made only one long run, but this furnishes rather definite information for this kind of service. First the lighter spent 4½ hours loading cargo in Bayonne, N. J., thence she ran to pier 13 North River (a 1½ hour run) and from there in a quartering 70-mile gale to New Haven, Conn. (an 8 hour run). The trip was made with 160 tons of cargo aboard, and the entire operation from Bayonne to New Haven consumed only 192 gallons of fuel. At 4 cents per gallon the cost was $7.68 for fuel burned during the entire trip. At another time 65 tons of pumps were unloaded and dropped into the hold of the steamer with 64 cents worth of fuel.

SETTLEMENT WITH BRITISH MINISTRY.—Chairman Lasker of the Shipping Board has announced that negotiations with the British Ministry of Shipping for settlement of claims, arising out of transactions during and after the war, have been concluded by the payment by the British Ministry of Shipping to the Shipping Board of $12,000,000.

Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Cause of Break at Point of Admission on High Pressure Indicator Card

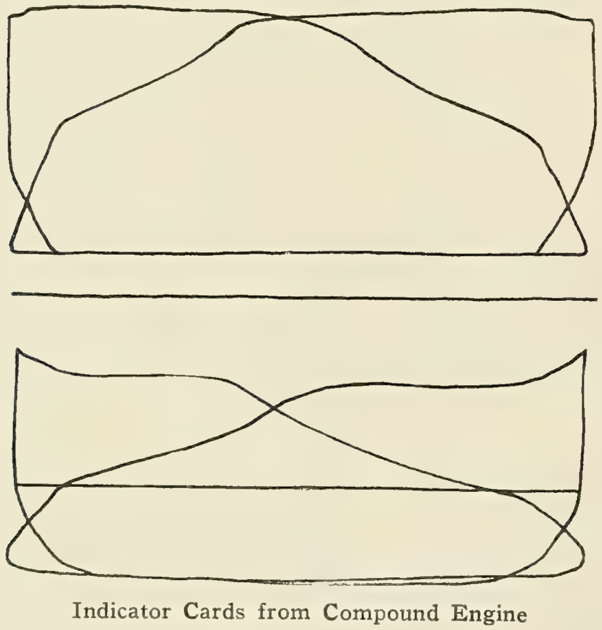
Q. (1164).—I am sending two indicator diagrams taken from an 18-inch by 38-inch by 26-inch compound condensing marine engine operating at 145 pounds steam pressure and 25-inch vacuum, 91 revolutions per minute at ⅝ cut-off. The high pressure card was taken with a 70-pound spring. What I am particularly interested in is to determine the cause of the break at the point of admission on the high pressure card.

At the time this card was taken, the boat was pulling a tow, and on the previous day's run, when the boat was running light and the engine turning 103 revolutions per minute, the card at the point in question was perfect.

My explanation is that there is lost motion in the valve gear and, under the load and slower speed, the valve overreached, causing lap and late admission. Another explanation is that these breaks were caused by condensation in the cylinder, to which I could not agree.

I will be pleased to have any information you or your correspondents could give to clear up this point.

A. (1164).—The high pressure card accompanying this question shows a break at the point of admission. This is caused by too late setting of the eccentric, resulting, as



Indicator Cards from Compound Engine

the valve starts to open, in wire drawing. The eccentric should be set ahead of its present position.

The reason this break does not appear when running light is in all probability due to the use of an indicator spring too light for the duty required. The speeding up of the engine from 91 revolutions per minute, while towing, to 103 revolutions per minute, while running light, undoubtedly gave enough added momentum to the pencil motion or the indicator piston spring to carry the pencil above the true admission condition thus tracing a perfect card at the point in question.

It is believed that, if cards be taken with a 100-pound piston spring, the break will show when running light as well as when towing.

Problem of the Hull and Its Screw Propeller

Q. (1165).—Referring to the paper on the above subject published last year in MARINE ENGINEERING AND SHIPPING AGE:

Type 2 vessels with basic slips of first order, whose value v/V and e.h.p./E.H.P. corrected for K, plots below basic S curves on Fig. 8 will have their Zs value taken from curve 2, Fig. 7, instead of curve 1. Should K be greater than unity in the case just mentioned, use 1.26 K in formula for I.H.P.d. (Pages 454 and first column, page 456, June, 1921, issue).

If the point referred to above plots on curve S, then I.H.P.d (lower part of first column, page 456, June, 1921, issue) equals I.H.P./10^{zp} x 1.26K, but if it plots below the curve S, then Log I.H.P.d equals Log I.H.P. plus 2 Log K (using 1.26 K for K)—2Zp plus Z_1 where Z_1 equals Zp value for e.h.p./E.H.P. corresponding to point on S curve (Fig. 8) where v/V intersects S curve. This is the formula given on page 456, June, 1921, issue (upper part of second column).

Referring to page 454, first column and thirteenth line from bottom; what is meant by the sentence beginning "These two types and type 2 of first order of apparent slips, etc."? There seems to be no formula given anywhere for I.H.P.d when plotted point on Fig. 8 falls below "C" curves.

Referring again to page 456, second column (lower half of column): Formula for I.H.P.d (type 2 vessels, second order of slip) is stated to be Log I.H.P.d equals Log I.H.P. plus Log K—2Zp plus Z_1 (if plotted point falls below upper set of "S" curves, Fig. 8).

In the formula at the top of the same column "2 log K" is used. Are both formulæ correct? There seems to be some discrepancy, for on page 403 of the May, 1921, issue, "2 log K" is used in explaining the reason for excess of actual power over estimated power in case of the fifth vessel, which vessel appears to fall under condition explained on page 456 of June issue, lower part of second column.

(a) What are the lower set of "S" curves (lower three of which are marked "C" and others—S-27 down to S-15), Fig 8 for? I find no formulæ for cases where plotted point falls below them (May, 1921, issue).

(b) Does e.h.p. in formulæ represent horsepower required to tow full size model? (Refer to Admiral Dyson's propeller formulæ.)

(c) Are "I.H.P.d" and "s" for types 1 and 3 vessels always determined by formulæ given in the May, 1921, issue, regardless of position of plotted point on Fig. 8? (Neglecting, of course, condition mentioned on page 553 of the June, 1921, issue.)

(d) Will tow boat propellers turn the same number of revolutions when towing as when running free, assuming tow does not interfere with flow of water either to or from propeller, and assuming steam pressures equal in both cases?

(e) Where can one find reliable tow boat propeller design data?

(f) Referring to Fig. 6, May, 1921, issue, are block coefficients on curve for type 2 hulls same as those on curve for 1 and 3 hulls, if projected on a horizontal line? For example: On curve for 1 and 3 hulls S.B.C. .50 falls on curve A = 30, will the same S.B.C. for type 2 hulls fall on curve A = 23.75 (approximate)?

A. (1165).—Your interpretation as to type 2 vessels with basic slips of the first order is correct.

The sentence referred to on page 454, beginning "These two types, etc." is in error and should read "These two types pass on down to v/V values shown by curves C, Fig. 8, etc." In connection with this sentence it should be stated that the correct location of these "C" curves has been and still is the cause of much study and uncertainty due to the scarcity of data of vessels showing true dispersal of the thrust column. For example, the destroyer now being classed as a type 1 vessel seems to fulfil the requirements of that class, yet due to the fact that it does not show a genuine dispersal of the thrust column nor cavitates at the points expected when referred to the "C" curves, brings a doubt as to whether it is not in reality a type 2 vessel.

When the plotted point falls below the "C" curves of Fig. 8 a "C" curve below those shown may be plotted in the following manner: Choose as a basis some curve such as S = .10. If it is desired to plot say an S = .05 curve, the value on that curve corresponding to any e.h.p./E.H.P. would be [(1-.10)/(1-.05)] × (the value of v/V on the S = .10 curve corresponding to the particular e.h.p./E.H.P. being used.)

The formlua referred to in the second column of page 456 is in error and should read: Log $I.H.P_d = \log I.H.P. + 2 \log K - 2 Z_p + Z_1$.

(a) The lower set of "S" curves, Fig. 8, are to be used with types 1 and 3 vessels and in exactly the same manner as the curves for type 2 vessels.

(b) The e.h.p. used in this article refers to the effective horsepower required to tow the actual vessel.

(c) The same formulæ given in the May issue are used for "$I.H.P_d$" and "S" for types 1 and 3 vessels regardless of position of plotted v/V and e.h.p./E.H.P. points.

(d) Revolutions towing will be less than when running free under conditions cited.

(e) There have been several instances where data were taken while towing United States naval vessels but in no case were the runs made over the measured mile, the speed having been estimated. In order to make an analysis of the data, since no overall effective horsepower was obtained, it would be necessary to add together the effective horsepower of each individual vessel, when available from model tank experiments, under the towing conditions and to this add the estimated power required to overcome the resistance of the idle propellers.

(f) The curve for type 2 vessels was intended for use in cases where information as to a vessel's general dimensions (such as displacement) was incomplete. It was plotted with values of 2 LAB/H and S and bears no known relation to the curve for types 1 and 3 vessels. Since the publication of this article the type 2 curve was abandoned and the types 1 and 3 curve was used for type 2 vessels as well.

NEW BOOKS

Motorship Year Book, 1922. Size, 7½ by 10⅜ inches. Pages, 100. Illustrations, 42. New York, 1922: Miller, Freeman and Company.

Compiled as a standard reference book on oil engines and oil-engined vessels for designers, operators, owners and students, this volume contains a complete detailed register of the motorships of the world, lists of marine Diesel and marine surface ignition engine builders of the world, the American Bureau of Shipping rules for the construction of marine internal combustion engines, Lloyd's revised rules for the construction and survey of Diesel engines and their auxiliaries, the United States Steamboat Inspection Service rules for the licensing of engineers of motor vessels and several articles dealing with matters of interest in the motorship industry.

Of chief value is the data given regarding motorships in existence. The list of vessels has been arranged chronologically according to the year in which the ships were built. As each item is numbered serially and an alphabetical index with the serial numbers accompanies the Register, the data regarding any vessel can be found very quickly. The Register is arranged in tabular form giving the serial number assigned to the vessel, the name of the vessel, its type, the names of the owners and the builders of the hull, the dimensions, tonnage, the number, type and make of engines, the total brake horsepower and the bore, stroke and revolutions of the engine. The Register has been carefully revised since first issued a year ago.

The book opens with a review of American motorship and oil engine construction during 1921. This is followed by a discussion of the use of tar oil fuel for Diesel engines, shaft diameters and ship conversions, exhaust piping and mufflers and forty-nine selected questions and answers for engineers about to take examinations for a marine operator's license for motorships.

LETTERS TO THE EDITOR

Wages Not the Principal Handicap

In the June issue of Marine Engineering and Shipping Age, Captain Eugene E. O'Donnell, manager, marine department, C. H. Sprague and Son, has given his opinions on the question of our merchant marine, and we believe truthfully, as far as he goes, but he has only stated a few of the reasons why we as Americans cannot meet foreign competition.

And, as we believe every American should know the truth, the whole truth and nothing but the truth, we as Americans ask that Captain O'Donnell finish his story, and as marine engineers we must demand in self-defense that the other side of the story be told.

Our reasons for asking Captain O'Donnell to finish are as follows:

First, while his figures as to the pay sheets of the two classes of ships compared with the same class of British ships are no doubt true and correct, we have only to look for a few more figures, also true and correct, and we see where Captain O'Donnell is misleading the public with the truth, but not the whole truth. The figures we ask for are the overhead or the shore expenses of the two companies operating the same class and number of ships, one American and one British; also the Shipping Board overhead for the American ships. If we can believe Admiral Benson's statement to the marine engineers in executive council in Washington, D. C., just before the wage war in May and June, 1921, we could not compete with our British rivals, if the American crews from the captain down worked for their board. Admiral Benson said that the total wages of an American crew was less than seven and one-half (7.5) percent of the total operating expense. Then a little later Senator LaFollette said from the Senate floor that at the very most it would not exceed ten (10) percent.

Now what we want is a comparison of the other ninety (90) percent. All we ask is a fair chance to prove to the world that we as American engineers can and will meet and defeat any kind of foreign competition, provided we are not handicapped with an unreasonable overhead or shore payroll.

Captain O'Donnell takes time to point out several defects in the American maritime laws, or rather what he calls defects. It is evident that he does not intend ever to sail again (if he ever did) or allow any of his boys (if he has any) to sail on anything but a passenger ship. If he did, he would not advise the several changes he has. He also thinks the subsidy bill should not demand more than forty (40) percent of Americans on American ships.

The statement that it will be hard to man our ships with Americans is not true. While it may force some deck and engine room help to become Americans, they are here and eligible and we claim that if this country is not good enough for them to become citizens of our country then the ships of our country are too good for them to sail on.

Portland, Ore. J. R. Snee, Secretary,
Marine Engineers' Beneficial Association No. 41.

Shore Expenses of American Steamship Companies

You have been kind enough to send me an advance copy of Mr. J. R. Snee's letter on "Wages Not the Principal Handicap." This was sent to me in order that I might make reply in view of the fact that he has taken issue with a paper which I presented before the Society of Naval Architects and Marine Engineers, entitled "The Operating Problems of the American Shipowner."

As Mr. Snee's letter deals in generalities and is not specific in character, I can hardly accept it as constructive criticism and while I do not desire to enter into a controversial discussion purely on the basis of generalities I shall, however, in this instance attempt to make a fitting reply.

Mr. Snee assumes to believe that the operating problem of the American shipowner so far as wages are concerned is one that is not entirely confined to the sea-going personnel, but rather emphasizes the fact that the overhead or office expense in the operation of a steamship line is largely responsible for our inability to compete in international trade. In this regard it may be said:

Shore expenses of American and British steamship companies in the operating and traffic offices differ only as salaries and wages on shore are generally different in America and Great Britain. It is doubtless true that American salaries and wages of the shore force are usually higher. It is also true that many current assertions as to the extravagantly high salaries paid American shore officials are grotesquely untrue. As a rule, only one man in an American shipping organization, except one of very great size, has a substantial salary, and he is the executive head who must bear not only executive but heavy financial responsibilities.

Only the Shipping Board can give the "overhead" of its steamers, for which your correspondent asks. As to private companies, I can speak only of my own case. With fifteen persons in our shore office, we are operating 4 steamers of private ownership and 6 steamers for the Shipping Board besides acting for 12 steamship companies calling at this port. I doubt very much whether a given number of British steamers is operated by a smaller force or with an overhead less than our own. The wages of officers and crews afloat have been emphasized in discussions of the merchant marine because these officers and men are so much more numerous and their payrolls are so much greater in the aggregate than those of the relatively small number of people employed ashore.

Wages and costs of subsistence represent together from 12 to 15 percent of the total operating costs of our cargo steamers. Fuel and supplies may be purchased for both American and foreign ships in the world's cheapest markets wherever they happen to be. The wages and subsistence differences are the main differences between our ships and their competitors under the Shipping Board's policy of selling its cargo steamers on the basis of the market prices of the world.

There was no purpose in my paper written for the Society of Naval Architects and Marine Engineers to exaggerate in any point the wage handicap upon American shipowners. We are not paying our good officers any more than they are worth. I did not say nor do I think that the Shipping Board should not demand more than 40 percent of Americans on American ships—I suggested that that was a good practicable point from which to work to the larger requirements of the present shipping bill, which provides that after two or three years at least two-thirds of the unlicensed men in the deck and engine departments must be citizens of the United States. Nor do I ask for any change in the La Follette seamen's law that would make it more difficult for any Americans to go to sea. On the contrary, all we ask in the way of amendments to that law are those that will give American ships and American boys a fairer chance and a more efficient discipline on shipboard. With this I am sure Mr. Snee will as a practical engineer agree.

With reference to the defects in our navigation laws, the recommendations for correcting these defects were made by a competent committee as the result of careful study of the subject, and in further consequence of the suggestions made by practical shipping people including owners, operators, licensed deck and engineer officers and others. These recommendations simply attempt to place us upon a parity so far as our navigation laws are concerned with our principal competitors.

There is no desire on the part of anyone, I am sure, to lessen the requirements for safety of life at sea but this report in effect and in the light of present day experience in reality increases those safeguards in a manner that is comparable with the best modern practice.

The gentleman's statement that it is evident that I do not intend to ever sail again (if I ever did) or allow any of my boys (if I have any) to sail on anything but passenger ships is innuendo and unworthy of an answer. Let me say for the gentleman's benefit, however, that I have sailed for a good many years—from boy to master. My ancestors for several generations were shipbuilders, shipowners or sailors and I should not be in the least surprised to find that my boy in due course will follow in the footsteps of his ancestors and I have no fear for him or any other boy, if the splendid suggestions of the navigation committee are adopted.

Captain Eugene E. O'Donnell,
Manager, Marine Department,
C. H. Sprague & Son.

Boston, Mass.

OBITUARY

Captain Humphrey Jones, a retired sea captain and for seventeen years an inspector of hulls in the United States Steamboat Inspection Service, died recently at his home, 417 East Twenty-fifth street, Brooklyn, N. Y., aged 73.

David Wood, a well known ship draftsman who was admired and respected by all with whom he came in contact, died at the Harbor Hospital, Bath Beach, Brooklyn, on Tuesday, June 27. Mr. Wood was born in Glasgow, Scotland, and served an apprenticeship as a draftsman in the shipyard of Charles Connell and Company. Afterwards he worked at the yards of Henderson Brothers, John Brown and Company on the Clyde and at the Harland and Wolff yard at Belfast.

David Wood

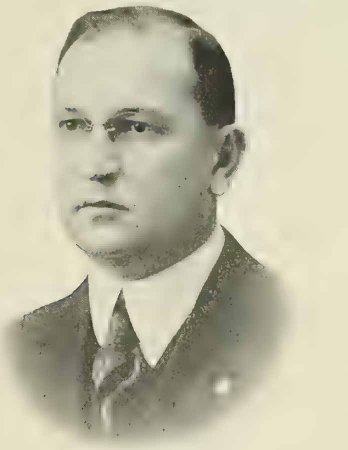
He came to the United States in 1896 and since then had worked at the following places: William Cramp and Son's Ship and Engine Building Company, Harlan and Hollingsworth, Newport News Shipbuilding and Dry Dock Company, Baltimore Dry Docks and Repair Company, Brooklyn Navy Yard, Bureau of Lighthouses, Emergency Fleet Corporation and the Federal Shipbuilding Company.

Mr. Wood was perhaps best known at the Brooklyn Navy Yard where he served 16 years. Recently, however, he had been connected with the Federal Shipbuilding Company and it was while at work at that plant on June 20 that he was taken ill. After receiving temporary treatment at the yard's hospital, he recovered sufficiently to be able to go to his home in Brooklyn where it was hoped that a few days' rest would set him on his feet again. On June 22 he was taken to the Harbor Hospital where he was operated on for appendicitis. After the operation he seemed cheerful and hopeful of being restored to health but unfortunately pneumonia set in from

which in his weakened condition he was unable to rally.

Funeral services were held at the undertaker's chapel on Ashland Place, Brooklyn, which were attended by a large number of his friends and he was laid to rest on the following day with full Masonic rites.

DAVID D. FARIS, appointed on July 1 as manager of the marine department of the Westinghouse Electric & Manufacturing Company, died suddenly in his office at the East Pittsburgh works of the Westinghouse Company on July 10, from apoplexy. Mr. Faris was born in Wheeling, W. Va., and was educated in the public schools and at the Linsly Military Academy in Wheeling, from which he graduated in 1896, going to work almost immediately for the Bellaire Steel Works, Bellaire, Ohio. At the outbreak of the Spanish-American War, he joined the army and went to the Philippines. Upon his discharge in 1899, at the end of the war, he took up a commercial course in the Elliot Commercial School in Wheeling and then came to Pittsburgh to work in the purchasing department of the National Tube Company.



David D. Faris

In 1901 he entered the employ of the National Cash Register Company in Dayton, Ohio, and a few months later became connected with the engineering department of the Pressed Steel Car Company in McKees Rocks, Pittsburgh. In May, 1904, he was employed in the production department of the Westinghouse Machine Company at East Pittsburgh and then was transferred to the sales department, where he remained for five years. He then was assigned to the Atlanta office as sales engineer, and later was engaged in the Chicago office. In 1912 he was given charge of the Detroit and Indianapolis offices of the Westinghouse Company. When the Westinghouse Machine Company was absorbed by the Electric Company in 1915 Mr. Faris returned to East Pittsburgh and was made assistant to the manager of the power department of the company. In 1919 he became assistant manager of the marine department, in which position he remained until his recent promotion.

Mr. Faris was an associate of the American Institute of Electrical Engineers, the Society of Naval Architects and Marine Engineers and the American Society of Naval Engineers.

PERSONAL MENTION

CHARLES C. MOSS, former inspector of repairs for the Munson Steamship Line, is now associated with Gibbs Brothers, Inc., checking up the work on the turbines of the *Leviathan* at the Newport News Shipbuilding and Dry Dock Company's yard, Newport News, Va.

T. PARK HAY is in charge of the United States Shipping Board Emergency Fleet Corporation office recently opened at 827-28 Marquette Building, Chicago, Ill. Mr. Hay was formerly manager of the St. Louis office of the Emergency Fleet Corporation. Harold C. King is his assistant. Besides acting as an intermediary between agents of American ships and exporters and importers, the office will promote cooperation between the railroads and the merchant marine.

CHARLES M. SCHWAB, chairman of the board of the Bethlehem Steel Corporation and of the Bethlehem Shipbuilding Corporation, Ltd., has been elected chairman of the board of directors of the Chicago Pneumatic Tool Company, Chicago, Ill., succeeding John R. McGinley, retired.

CAPTAIN W. A. HINDON has been made port captain of the United States Shipping Board, port of Boston to relieve Captain John J. Coholon, resigned. During the war, Captain Hindon was on the staff of the commandant at the Hampton Roads Naval Base and also served as executive officier on several navy transports.

FRANK E. SCOTT was appointed on July 1 by the United States Shipping Board Emergency Fleet Corporation as general western representative, with headquarters at Chicago, of the following steamship lines: United States Lines, Baltimore Steamship Company, W. A. Blake & Company, Black Diamond Steamship Company, Export Transportation Company. These companies operate Shipping Board tonnage from the North Atlantic to the United Kingdom and Continental European ports, giving frequent and regular service from all important North Atlantic ports to the important ports in the United Kingdom and on the Continent.

W. L. BUNKER, formerly manager of the Egan Refractory Engineering Company, has been appointed superintending engineer of the United States Lines. Mr. Bunker is a Californian and began his engineering career about thirty years ago. Eight years spent in the shops and drawing offices of the Union Iron Works Company of San Francisco gave him a good foundation for practical marine work and this was followed by several years in the transport service, beginning at the time of the Spanish-American war. He then went with the Pacific Mail Company, serving twelve years on passenger ships running to the Orient, going through all the grades of engineering and serving for the last six years as chief engineer of the S. S. *Manchuria*. Mr. Bunker then went with the Great Northern Pacific Steamship Company, where he worked for three years as chief engineer and superintending engineer. His next position was that of chief inspector of the United States Shipping Board in San Francisco, which he left after six months to enroll as a lieutenant in the Navy, where he served for sixteen months, leaving with the rank of lieutenant-commander. He was one of the first reserve engineers to receive this rank and he left the Navy with an excellent war record, having received a letter of recognition from Secretary of the Navy Daniels.

W. L. Bunker

Upon leaving the Navy, Mr. Bunker again joined the United States Shipping Board as chief inspector in charge of construction and repairs in Philadelphia and New York. After a year and a half in this position, he left to join the Lord Dry Dock Corporation, where he remained for eighteen months as general manager. Again, after one year as marine surveyor in New York, Mr. Bunker became manager of the Egan Refractory Engineering Company, the position which he left to take his present position.

Much of Mr. Bunker's marine experience has been with the handling of passenger ships. He is a diligent worker and has earned for himself the enviable reputation of living up to his motto of "A Square Deal for Everyone."

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

Business Improvement

A PRONOUNCED upward turn from the low mark of the post-war ebb in the tide of shipyard business is shown by figures compiled by MARINE ENGINEERING AND SHIPPING AGE for the first half of 1922.

From January 1 to July 1 there has been reported ship construction and repair work as under contemplation having a total estimated value of $73,782,517 and contracts placed for similar work during the same time amounting to $28,905,186.

Figures for the first three months of the year showed $34,927,000 reported as work in contemplation and $14,930,206 in actual contracts placed. For the quarter ending July 1 the figures are $38,855,517 and $13,974,980 respectively.

In addition to these figures, there is at present every indication that contracts for at least seven new combination passenger and freight ships, as well as a number of other types of commercial vessels, will be placed this year.

There is also a strong possibility that orders may be placed in this country for either submarine torpedo boats or submarine mine layers for foreign accounts. Tentative bids have already been received or requested from American builders. The award of any one of the several contracts being considered in this connection would involve many millions of dollars.

Reconditioning of Agamemnon and Mount Vernon, Involving Millions, Receiving Serious Consideration

Washington Officials Understood to Be Investigating Probable Cost of Putting Ships in Service—Action on the President Grant May Be Deferred

FROM $3,700,000 to $4,500,000 will be required for reconditioning of the steamships *Agamemnon* and *Mount Vernon*, according to information obtained by MARINE ENGINEERING AND SHIPPING AGE. It is learned that the question of putting these vessels into shape for service is receiving serious consideration in Washington, as it is believed that the operation of these or similar ships will be necessary to provide running mates for the *Leviathan*.

Unofficial estimates of the cost of overhauling the *Agamemnon* and the *Mount Vernon* placed the totals, including general specifications, oil fuel installation, stewards' supplies and ship furnishings at about $2,500,000 for the former and slightly over $2,000,000 for the latter. This reconditioning would provide for 22 knots speed, using oil for fuel.

For reconditioning the same vessels for 18 knots speed, using coal for fuel, the total figures for the *Agamemnon* would be close to $1,900,000 and for the *Mount Vernon* $1,800,000.

It is believed that the reconditioning of the *President Grant*, including general specifications and stewards' supplies and ship furnishings, would cost about $900,000.

It is understood that in the case of the *Mount Vernon* and the *Agamemnon* preliminary estimates were prepared on a basis of operating the ships at a speed of 22 knots, using oil for fuel, with an alternative estimate of service at 18 knots, using coal for fuel.

It is probable that three months will be required for the preparation of plans and specifications on the *Mount Vernon* and *Agamemnon* and the actual work of reconditioning these two vessels as coal burners would require six months' time and, with oil burners, seven months.

The ships have an over all length of 706 feet 6 inches; length between perpendiculars, 680 feet 4 inches; breadth, 72 feet; depth, 44 feet 2 inches and a gross tonnage of 19,503.

As oil burners, passenger accommodations can be provided for about 600 first class, 300 second class and 600 third class passengers, while, as coal burners, accommodations can be provided for over 500 first class, 300 second class and 350 third class passengers.

Steamship Comus To Be Converted Into Oil Burner

THE steamship *Comus*, of the Southern Pacific Steamship Company, went to the plant of the Robins Dry Dock & Repair Company, Brooklyn, N. Y., of the Todd Shipyard Corporation, where she will be converted from a coal to an oil burning ship.

$1,840,000 Job Awarded Newport News Shipyard

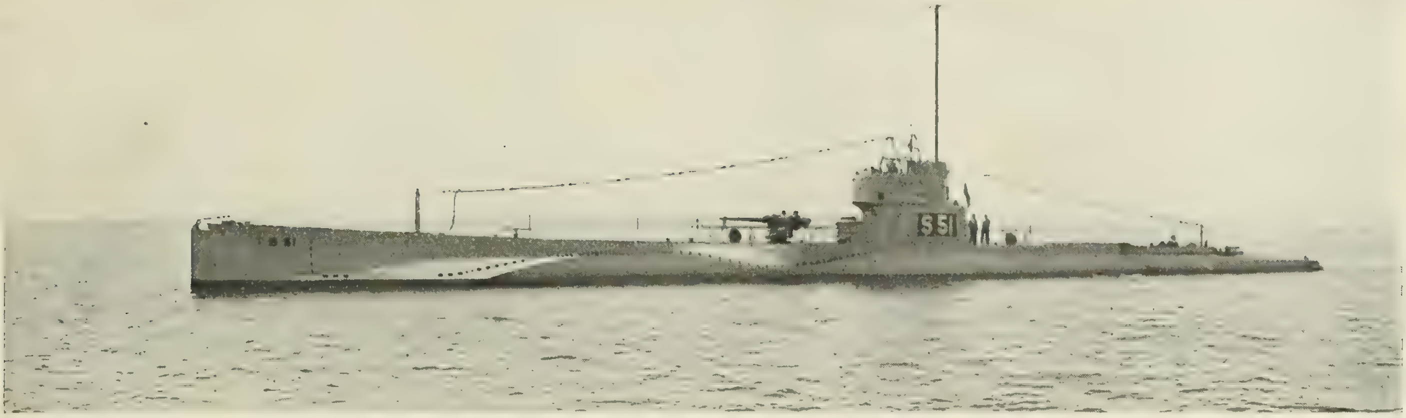
THE Newport News Shipbuilding and Dry Dock Company, Newport News, Va., has been awarded the contract for the construction of two combination passenger steamers for the Ocean Steamship Company, of Savannah, following the opening of tenders at Pier 35, North River, New York, on June 29. There were eleven bids submitted for the work, the Newport News price being $920,000 for each ship.

The vessels will be built of steel, the propelling machinery consisting of inverted, direct acting, triple expansion, surface condensing engines, having cylinders 26, 43 and 72 inches diameter by 48-inch stroke, designed to develop 2,900 indicated horsepower, steam being supplied by four single-ended, cylindrical, return tube boilers. The ships, which are to be similar in type to the company's steamships *City of St. Louis* and *City of Montgomery*, are for delivery in 1923, the first by September 1 and the second by October 1. They will accommodate about 228 passengers each.

Diesel Yacht Contract Awarded Newport News Yard

NEWPORT NEWS, Va. (Special.)—The Newport News Shipbuilding & Dry Dock Company has been awarded a contract for the construction of a seagoing Diesel yacht, 172 feet by 26 feet by 12 feet. The vessel will be propelled by two 350 horsepower Winton Diesel engines.

The yacht was designed by the firm of Cox & Stevens, naval architects, of New York City. It is understood she will be named the *Ohio* and will cost close to $350,000.



S-51, After Completing Successful Trials

Submarine S-51, Last of the Lake Company's Construction Program, Is Officially Delivered

THE submarine *S-51* built by the Lake Torpedo Boat Company, at Bridgeport, Conn., was officially turned over to the United States Government by that company at the Lake shipyard, on Saturday, June 24. With a band playing and flags flying, Lieutenant Commander W. S. Haas, U. S. N., assumed active command of the vessel. Simon Lake, designers and other engineers of the contracting company and a large party of invited guests witnessed the ceremony.

The turning over of the *S-51* to the Navy completes the Lake Company's present building program. The ship is the last word in submarine construction and gave a highly creditable performance when she ran her sea trials recently.

Gahagain Company Takes $491,904 Job for 12 Sea Scows

THE W. H. Gahagain Company, of Brooklyn, New York, has been awarded the contract by the City of New York for the construction of twelve seagoing side dumper scows for use by the Department of Street Cleaning. The company's bid was $40,992 as a unit price with a total figure of $491,904.

The specifications provide for a heavily constructed wooden boat having a length inside of fenders of 134 feet; breadth outside to outside of side planks, 37 feet; depth molded to center top of deck plank to bottom of bottom plank, 14 feet; the boats to be fully equipped.

Conversion of San Lorenzo Awarded To Sun Company

THE Sun Shipbuilding Company, of Chester, Pa., has been awarded the contract to insulate and convert the steamship *San Lorenzo*, of the New York and Porto Rico Steamship Company, into an air-cooled fruit carrier, following the opening of bids at 25 Broadway, New York city, on July 7. The Brunswick Refrigerating Company's machinery will be used and when completed the ship will have about 120,000 cubic feet of space available for cargo. She will be returned to service between New York and San Juan. The successful bid was $138,768, the work to be done in 60 running days.

The steamship company has also purchased a new high-pressure cylinder for the *San Lorenzo* from the Sun Company, which will be installed in the course of the overhauling and during the layup the ship will be classed by the American Bureau of Shipping.

Newport News Yard Gets Middlesex for General Overhauling

THE Newport News Shipbuilding & Dry Dock Company was awarded the contract for overhauling the steamer *Middlesex*, of the Coastwise Transportation Company, following the opening of bids at the office of Frank S. Martin, naval architect and marine engineer, of 25 Broadway, New York City. The contract provides for a long drydocking job including considerable steel work. The bids submitted were as follows:

Newport News Shipbuilding & Dry Dock Co.	$134,986	60 days
Morse Dry Dock & Repair Co.	155,000	57 days
Robins Dry Dock & Repair Co.	157,000	70 days
Alderton Dry Docks	160,000	55 days
Tietjen & Lang	162,354	72 days
James Shewan & Son	165,000	43 days
Bethlehem Shipbuilding Co.	249,800	65 days

Freighter to Be Built by American Yard, Cleveland

THE American Shipbuilding Company, of Cleveland, Ohio, has been awarded a contract by the Pandor Steamship Company, of Cleveland, for the construction of a steel freighter of 12,000 deadweight tons, similar in type to the vessels the shipyard now has under construction for other lake carriers.

The vessel will have a length between perpendiculars of 580 feet, beam 60 feet and depth 32 feet. She will be propelled by a triple expansion reciprocating engine, and cost about $800,000.

Bethlehem Plant Awarded Two Ships For Eastern Lines

THE contract for the construction of two coastwise freighters for the Eastern Steamship Lines, Inc., of Boston, Mass., has been awarded to the Bethlehem Shipbuilding Corporation at a total price of $287,000 each. Bids for the construction of one, two or three of these ships were received on Wednesday, June 14. Construction work will start immediately at the Sparrows Point plant of the Bethlehem Corporation, the first ship to be built in 180 days and the second ship in 200 days.

The ships will be of the hurricane shelter deck type, having an overall length of 233 feet 3 inches, length between perpendiculars 221 feet 6 inches, beam molded 38 feet, load draft 17 feet, 1,400 deadweight tons and developing a speed of 11½ knots. It is understood that the propelling machinery will consist of reciprocating engines purchased from the Shipping Board and built by the Hooven, Owens, Rentschler Company. Steam will be supplied by two, oil burning, single ended, Scotch boilers of the two furnace type, delivering steam at 190 pounds working pressure.

The vessels were designed by Theodore E. Ferris, naval architect of 30 Church Street, New York City.

Robins Yard Gets S.S. President Pierce on Bid of $229,000

THE Robins Dry Dock & Repair Company of the Todd Shipyards Corporation with a price of $229,000 was awarded the contract of reconditioning the steamship *President Pierce*, formerly the *Hawkeye State*, following the opening of bids by the Shipping Board, 45 Broadway, New York, on June 27. The work includes extensive hull and engine repairs.

Self-Unloading Collier Is Contracted For

James Playfair, of Midland, Ontario, has signed a contract with the Midland Contracting Company for the construction of a self-unloading canal sized collier.

Building of Two Steel, Turbo-Electric Ferries Under Way

MARKING the first steel ship contract work undertaken at any Los Angeles yard since the war, the first plans for the keels of two steel double ended ferry boats were laid on June 29, at the plant of the Los Angeles Shipbuilding and Drydock Corporation. The construction contract amounts to $586,000, outside of equipment, and was secured by the local yard in sharp competition with northern shipyards.

The vessels are to be built under the supervision of John B. Matthews, naval architect and engineer, who designed them as the first turbo-electrically driven ferryboats ever laid down in any yard. The propelling machinery is of a similar type as that used in modern warships and is said to provide a saving of 30 percent in horsepower as well as to effect a great economy in fuel and simplicity in operation. The construction work promises to provide employment for several hundred men and this activity taken in connection with the establishment of a modern lumber yard, with sawmills and box factories at the same plant, is expected to re-establish the Los Angeles yards in their old position as among the largest employers of labor in the harbor district.

Bids for Seven Millions in Submarine Mine Layers Requested from Contractors in America

Prices Asked by South American Government for Construction of from Three to Five Vessels in Addition to Undersea Torpedo Boats

A SOUTH AMERICAN government is again in the American market for a number of submarine vessels having an estimated total value of $7,000,000, according to information obtained by Marine Engineering and Shipping Age. Argentine, Brazil and Chile have already received tenders from American builders for the construction of from six to twelve submarine torpedo boats of the latest type, the cost of which would range from five to eighteen million dollars, the latest development being a request for estimates on three, four or five submarine mine layers. It is believed that these latter vessels would involve the expenditure of from $5,000,000 to $7,000,000.

Proposals for vessels of the mine-layer type will probably provide for a submarine about 200 feet in length, driven by two 1,000-horsepower oil engines developing a speed of from 15 to 16 knots.

Each vessel would be equipped complete with auxiliary machinery, including electric motors, storage batteries, mine handling mechanism, pumps, wireless apparatus, etc. Unofficial figures give the approximate displacements of these proposed boats as follows: Net submerged tons, 870; surface displacement, 720; submerged depth, 200 feet.

Contract Placed for Rebuilding of C. & O. Pier at Norfolk, Va.

The J. T. Nuchols Company, of Richmond, Va., has been awarded contract for rebuilding the Chesapeake & Ohio pier and warehouse, burned at Norfolk, Va., several months ago. The amount of the contract has not been made public, but it is believed to be less than the $125,000, which was the amount of the first estimate.

The new pier and warehouses will be fireproof, constructed of reinforced concrete and steel. It will be 450 by 52 feet, approximately, and will more than compensate for the space lost

United States Only Country to Show Increase in Shipbuilding During the Past Three Months

Figures of Lloyd's Register of Shipping Credit United States With Gain from April 1 to July 1—World Shipbuilding Below Pre-War Level

WORLD shipbuilding today is actually below the pre-war level, says a statement just issued by Lloyd's Register of Shipping. The decrease in production has been steady since the fall of 1919, and the volume of new orders continues to be far below the completion of orders in hand.

While the returns for the quarter ended July 1 show that the aggregate of contracts in hand is nearly 800,000 gross tons more than the total at July 1, 1914, so many suspensions of work have been directed by those who placed the orders that the actual volume of construction actively under way is slightly below the pre-war figure.

Although there has been a sharp shrinkage in the gross aggregate of tonnage in hand during the past three months, Lloyd's Register points out, the total for the shipyards of the United States shows a small gain. On April 1, the American aggregate was lower than before the war, but on July 1 it was slightly above the pre-war figure. This country, however, was practically the only one in the world to show a gain during the past quarter.

The gross aggregate of tonnage on July 1, as compared with the previous quarter, was as follows (in gross tons):

	July 1	*April* 1
United States	150,623	136,266
United Kingdom	1,919,504	2,235,998
Other countries	1,165,303	1,307,358
World total	3,235,430	3,679,622

Stoppages ordered on this work fell more heavily on British shipyards than on those of all the other maritime nations combined, says Lloyd's Register, the result being that, while the actual British total is nearly 300,000 tons below the pre-war figure, the aggregate of the other shipbuilding countries is about 250,000 tons higher than in 1914. The following shows the result of the last quarter's suspensions, in gross tons:

	Britain	*Others*
Work contracted	1,919,504	1,315,926
Less suspensions	481,000	290,000
Actual work	1,438,504	1,025,926

The actual construction under way at present, as compared with that just before the war, shows how British shipyards have been affected:

	July 1,1914	*July* 1, 1922
United Kingdom	1,722,000	1,438,504
United States	148,000	150,623
Other countries	626,000	875,303
World total	2,496,000	2,464,430

The world construction now actually under way shows a decline of nearly 5,600,000 gross tons from the peak, which was attained in September, 1919, when 8,048,000 tons were being built, Lloyd's Register states. This country's present total of 150,000 tons, compared with the high level of 4,186,000 tons reached in the first quarter of 1919, shows a decrease of more than 95 per cent.

Bethlehem Begins Construction of Two 20,000-Ton Ships

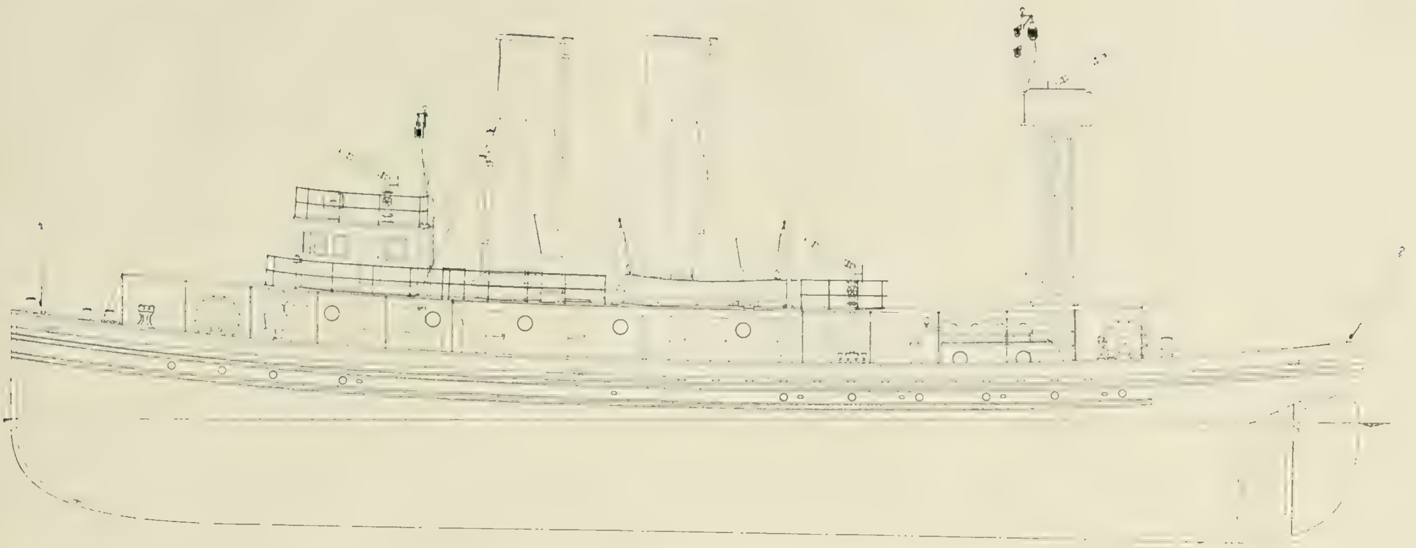
THE Bethlehem Shipbuilding Corporation has begun the construction of two 20,000-ton cargo ships at their Union plant, San Francisco, California. These ships are to be combination ore and coal carriers similar to the ore and oil carriers already built by that company.

The vessels will be named the *Chilore* and *Lebore*. They will each have an over all length of 571 feet 6 inches, length between perpendiculars 550 feet 1 inch, beam molded 72 feet. The propelling machinery will consist of two Bethlehem-Curtis type turbines developing a maximum of 5,000 horsepower. Steam will be supplied by three single-ended Scotch boilers burning oil for fuel and developing a working pressure of 220 pounds. The cargo space of each ship will have a total capacity of 911,856 cubic feet.

Virginian Railway Will Build Three Million Dollar Pier

ACCORDING to announcement by C. H. Hix, Vice-President of the Virginian Railway, the railway will build a new coal pier at Sewall's Point terminals, more than doubling the capacity of the plant to dump coal. The expenditure involved will be about $3,000,000. Bids will probably be asked in the near future as plans are now being prepared. Mr. Hix said that he hoped to have the preliminary work on the pier started in two months and that it should be completed in two years.

Construction of the new pier will add about one-fourth to the coaling facilities of the port.



Outboard Profile of Fireboat to Be Built for New Orleans

New Passenger and Freight Ship is Under Consideration by New York and Porto Rico Line

Theodore E. Ferris, New York Naval Architect, Commissioned to Prepare Plans and Specifications—Bids May Be Asked in from Three to Five Weeks

THE construction of a new steel combination passenger and freight steamer is being contemplated by the New York and Porto Rico Steamship Company, according to official information obtained by Marine Engineering and Shipping Age. Theodore E. Ferris, naval architect, of 30 Church Street, New York City, has been commissioned to prepare plans and specifications and it is probable that bids for the contract will be asked in from three to five weeks. It is believed the cost of the proposed vessel will be close to one million and a half dollars, at present prices of materials.

According to preliminary figures, the ship will be about 425 feet in length, propelled by turbine engines of sufficient power to develop speed of 15 knots. Accommodations will be provided for approximately 200 first and 60 second class passengers, the public rooms and other equipment being designed for the maximum of convenience and comfort.

The new steamship will be of a type similar to the company's ship *San Lorenzo*, now being reconditioned at the plant of the Sun Shipbuilding Company.

Government to Order New Steam Driven Tender

BIDS will shortly be invited by the Bureau of Lighthouses in Washington, D. C., for the building of a new steel, stern-wheel tender for the Ohio and Monongahela Rivers, with headquarters at Cincinnati, Ohio.

The new vessel will replace the *Goldenrod*, now operating in these waters, and will be named the *Greenbrier*. She will be 165 feet overall, 140 feet length of hull, 32 feet 6 inches beam over the guards, and will draw 32 inches when in light steaming condition, 42 inches when fully loaded.

The motive power will be furnished by two horizontal high pressure steam engines operating at 200 pounds working pressure and horizontal flue boilers with natural draft.

Steam heating, hot and cold water service, electric light and steam steering gear will be provided. A noticeable feature in the design is two kerosene burning ranges in the galley, the use of which eliminates much of the heat of coal ranges and avoids the carrying of hard coal for cooking.

Reconditioned Fireboat Passes Successful Tests of Equipment

TESTS held recently on the New York fireboat *Thomas Willett*, at the Clinton plant of the Todd Shipyards Corporation, were pronounced highly satisfactory by Fire Chief J. J. Henry, consulting engineer of the department.

The *Thomas Willett* has just had new turbines and pumps installed by the Todd Corporation, and in the presence of expert engineers from the fire department, the National Board of Underwriters and Clinton Dry Docks, Inc., the boat gave a performance that Chief Henry said was better than he had ever seen in his thirty years experience.

At a pressure of 300 pounds, the pumps discharged 4,700 gallons of water per minute; at a pressure of 175 pounds, the pumps delivered 7,500 gallons per minute; at a pressure of 150 pounds, the pumps delivered 9,200 gallons of water per minute.

The fireboat's three turrets threw a 3-inch stream a distance of 400 feet, and with six stand pipes in operation six 2-inch streams of water were thrown a distance of 200 ft.

Those present at the tests, which lasted four hours, were:—Chief E. J. Worth, Chief J. J. Henry, Herbert Tracey, Fred Thompson, Lieut. George McNear of the New York Fire Department, F. A. Raymond, N. N. Walpert, H. E. Newell of The National Board of Underwriters, Paul D. Goodman, J. Hollander, W. F. Mayer, George Worley, Frank Howell, George J. Robinson, Frank Taylor, Joseph Haig and J. Herbert Todd.

Johnson Plant to Build Fireboat for New Orleans

THE Johnson Iron Works, Dry Dock & Shipbuilding Company, Inc., of New Orleans, La., has been awarded the contract for the construction of a steel screw fireboat for the city of New Orleans at a price of $264,447, the vessel to be completed in 220 days. Bids for the construction of this boat were opened on June 29.

The vessel will be 138 feet 6 inches long, driven by compound engines with cylinders 20½ inches and 46 inches in diameter and 28 inches stroke, steam being supplied by two watertube boilers, fitted to burn oil for fuel. She will be equipped with four turbine-driven fire pumps of a combined capacity of 10,000 gallons per minute and was designed by and will be built under the supervision of Cornell and Matthews, naval architects and marine engineers, of Philadelphia.

Contract for Three Tugs Goes to Tebo Plant

Orders for the construction of three steel, single screw tugboats for the New York Central Railroad have been placed with the Todd Shipyards Corporation, the lowest bidder. Construction will be commenced within a few days at the Tebo plant, in Brooklyn, and delivery is expected to be made by the end of January, 1923.

The boats are to be oil burning equipped with Todd mechanical oil burners. They will be 108 feet overall length, 25 feet 6 inches beam, 12 feet 9 inches molded depth.

Business Address

The Mahr Manufacturing Company, of Minneapolis, Minn., makers of the "Mahrvel Line" of oil burning equipment, have arranged to have W. H. White take care of their New York business. His offices are located at 56 Murray street, New York.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Steamer Repairs, Portland, Ore.—The American-Hawaiian steamer Iowan was awarded to the Albins Marine Iron Works, Portland, Ore., for repairs.

Steam Schooner's Hull Repaired, West Coast.—The schooner Virginia Olson has been removed to the Bethlehem Shipyards to repair the damage done to her hull in collision with a submarine.

Drydocking of Steamer, San Francisco, Cal.—The steamer Johanna Smith called at San Francisco, Cal., en route to Oregon from San Pedro to go on dry dock for annual inspection and repairs.

Contracts Awarded by Shipping Board.—The Shipping Board awarded repairs to steamship Chappaqua to Maryland Dry Docks Company at $868, repairs to Standard Oil Company's tank barge American to same plant at $2,647.

Repairs at Moore Yards, Oakland, Cal.—Steam schooners Arctic and Pasadena, barkentine James Johnson and lightship No. 76 went on Moore ways for cleaning, painting and repairing.

Condenser Repairs to Steamer, Savannah, Ga.—The Wilkinson Machine Company, of Savannah, Ga., repaired condenser on Edward Munch, a sugar vessel, discharging cargo of 30,000 bags of raw sugar at the refinery, Savannah.

Steamer Overhauled, Savannah, Ga.—The same company was also awarded the contract for generally overhauling the Farnsum.

Tanker Overhauled, Portland, Ore.—The Union Oil Company's tanker Oleum, which lost two propeller blades while en route up the Columbia River, was placed on drydock at Portland, Ore., for annual overhauling and inspection.

Tankers Overhauled for Renewed Service, San Francisco, Cal.—The Standard Oil Company has decided to place a number of their idle oil carriers in service again and has sent the tanker Algonquin to Union Iron Works docks for overhauling; S. C. T. Dood at Alameda for reconditioning, and F. H. Hillman to undergo reconditioning.

Ferryboat Completely Overhauled, San Francisco, Cal.—Ferryboat San Pablo was completely overhauled, inside and out, on ways of the Bethlehem Shipbuilding Company.

Overhauling and Repairs, San Francisco, Cal.—Tanker Richmond went to Union Iron Works for overhauling and freighter Bessie Dollar to No. 4 ways, for general repairs.

New Propeller on Steamer, Oakland, Cal.—Steamer Sonoma received new propeller at the Moore yards.

Contract Awarded, Pittsburgh, Pa.—Marine Manufacturing and Supply Company received contract to re-build sidewheel ferryboat Transit into sternwheel craft. New engines are 8 by 3, high pressure. The boat, built three years ago, is in Wellsburg, Ohio—Brilliant, West Virginia, trade.

Ship Overhauled, Pittsburgh, Pa.—Steamer Elizabeth Smith overhauled at landing of Marine Manufacturing and Supply Company, Pittsburgh, Pa.

Steamer Drydocked, Sun Yards, Chester, Pa.—British steamship Slavic Prince was drydocked at Sun yards, Chester, for miscellaneous repairs.

Repairs to Steamships, Mobile, Ala.—Steamships Maquan and Jeff Davis, consigned to Trosdal, Plant & Lafonta, underwent repairs.

Freight Carriers to be Reconditioned, Atlantic Coast.—Three freight carriers of 4,200 deadweight tons each, recently bought by the Matson Navigation Company are to be reconditioned on the Atlantic Coast before going into service between San Francisco and the Hawaiian Islands. They will be converted to oil burners. The steamers are the Coverun, the Cowee and the Cowboy.

Ship Repairs, Chester, Pa.—The steamship Agwimex, of the New York and Cuban Mail Steamship Company, went to the Sun Shipyard for boiler repairs, motor alterations and miscellaneous repairs to hull and engines.

Vessel Repairs, Hoboken, N. J.—W. & A. Fletcher Company, Hoboken, N. J., was awarded the steamers Clairmont for drydocking and painting; J. R. Gordon for general repairs, drydocking, and General Gorgas for drydocking, scaling underwater body, painting and repairing damage to bottom plates, the total amount involved being about $6,000.

Contract for Sea Dumper Scows, Brooklyn, N. Y.—W. H. Gahagain Company was awarded contract by City of New York for construction of twelve seagoing side dumper scows for use by Department of Street Cleaning. Unit bid, $40,992; total figure, $491,904.

Trial Trip of S-51, Bridgeport, Conn.—Submarine S-51, built by Lake Torpedo Boat Company, at Bridgeport, Conn., was officially turned over to United States Government by that company at Lake shipyard, Saturday, June 24.

Reconditioning of Steamer, Brooklyn, N. Y.—Robins Dry Dock & Repair Company, of Todd Shipyards Corporation, with a price of $229,000, was awarded contract for reconditioning steamship President Pierce.

Construction of Freighters, Sparrows Point, Md.—Contract for construction of two coastwise freighters for Eastern Steamship Line, Inc., Boston, Mass., was awarded the Bethlehem Shipbuilding Corporation at price of $287,000 each.

Contract Awarded, Cleveland, O.—American Shipbuilding Company was awarded contract by Prandas Steamship Company, of Cleveland, Ohio, for construction of steel freighter of 12,000 deadweight tons, similar to vessels shipyard now has under construction for other lake carriers.

Collier Contracted For, Midland, Ont.—James Playfair, of Midland, Ontario, has signed contract with Midland Contracting Company for construction of self-unloading canal sized collier.

Lighthouse Tender, Washington, D. C.—Bids to be shortly invited by Bureau of Lighthouses in Washington, D. C., for building of new steel, sternwheel tender for Ohio and Monongahela Rivers, with headquarters at Cincinnati, Ohio.

Two Ferries, San Pedro, Cal.—Los Angeles Shipbuilding and Drydock Corporation is to construct two steel, turbo-electric ferries. Construction contract amounts to $586,000 outside of equipment.

Overhauling of Steamship, Newport News, Va.—Newport News Shipbuilding & Dry Dock Company was awarded contract for overhauling steamer Middlesex, of Coastwise Transportation Company. Price, $134,986 (60 days).

Construction of Cargo Ships, San Francisco, Cal.—Bethlehem Shipbuilding Corporation has begun construction of two 20,000-ton cargo ships at their Union plant. These ships are to be combination ore and coal carriers similar to ore and oil carriers already built by that company.

General Repairs to Lighthouse Tender, Los Angeles, Calif.—Lighthouse tender Sequoia was taken to Los Angeles Shipbuilding & Dry Dock Corporation for hull scaling, painting and general machinery overhauling. Her service ranges from Panama to Alaska as lighthouse tender.

Contract Awards, Maryland.—Repairs to Atlantic, Gulf & Pacific steamer Cape Romain were awarded the Maryland Dry Dock Company, steamer Hoxie, of Baltimore Steamship Company's fleet, was docked at lower plant of the Bethlehem Shipbuilding Corporation, and barge Northern No. 44 was taken into upper dock.

Contract Awarded, San Pedro, Calif.—Shipping Board awarded contract for reconditioning steamers Huron and Aeolus to Los Angeles Shipbuilding Company. Total price, $137,928.

Steamship Conversion, New York.—Mallory Line contemplates converting steamer Medina from coal to oil burner.

Reconditioning of Steamer, Hoboken, New Jersey.—San Jacinto extensively overhauled, two new triple expansion engines installed and converted to oil burner; renovation of passenger accommodations, etc. Approximate cost, $700,000. Work completed by Tietjen & Lang Shipyards.

Probable Conversion to Motorships, New York.—Munson Steamship Company will probably convert recently purchased ships, two in number, to motorships. Expected the work will cost over $50,000 for each ship.

Morse Yard Receives Contract, Brooklyn, N. Y.—Morse Dry Dock & Repair Company, with price of $177,445, was awarded work of reconditioning steamer Buckeye State, following opening of bids by Shipping Board at 45 Broadway, New York.

Contract for Diesel Yacht, Newport News, Va.—Newport News Shipbuilding & Dry Dock Company awarded contract for construction of seagoing Diesel yacht, 172 feet by 26 feet by 12 feet. Vessel will be propelled by two 350 horsepower Winton Diesel engines.

Diesel Engine Installation.—William Cramp & Sons Ship & Engine Building Company equipped steamship Seekonk, recently purchased by them, with Burmeister & Wain engine. An order for two three-cylinder 125-horsepower mechanical-injection Diesel engines for ocean trawlers has been placed with the Atlas Imperial Engine Company by Western California Fish Company. Contract for the hulls was placed with the W. F. Stone & Son, Oakland, Calif.

Drydocking and General Repairs, San Francisco, Cal.—Coast guard cutter Seift went to Crowley's to undergo drydocking, general repairs and installation of new propeller. Army mine planter General Franklin K. Bell was also at Crowley yards undergoing a general overhauling.

Lightship Drydocked, San Francisco, Cal.—Lightship Blunts Reef was taken to Goat Island to undergo thorough cleaning and possible drydocking.

Savannah Concern Lowest Bidder on Government Dredges.—Wilkinson Machine Company, of Savannah, Ga., was awarded contract for emergency repairs on all of the government pipe line and seagoing dredges, operated in that district, at a price of $3,318.35.

Repairs to Steamer, Portland, Ore.—Steamship Santa Veronica was drydocked to replace a broken tail shaft and ship a new wheel at Portland Drydocks.

Wireless House Installed, San Francisco, Cal.—United States army transport Meiggs went to Crowley Shipbuilding Company to have new wireless house installed. Contract price for work was $5,100, and bid of Crowley Yards was lowest.

Contracts Awarded Fletcher Company, Hoboken, N. J.—Steamship Moldegaard, owned by A. H. Bull and Company, was taken to Fletcher yards for generally reconditioning; Eastern Dawn, of United States Shipping Board, for general overhauling; steamship Lebannon, owned and operated by Globe Line, for drydocking, examination and painting, etc.; Severance, owned and operated by Union Sulphur Company, drydocked, painted and generally overhauled; President Polk, owned by United States Shipping Board, for usual trip repairs. The yard also completed work of reconditioning steamship Philadelphia, formerly of the American Line, and now owned and operated by New York and Naples Steamship Company.

SHIPYARDS AND DRY DOCKS

Floating Drydock, etc., Guaymas, Manzanillo, Mexico.—Government of Mexico plans floating drydock, marine railway and repairing equipment. Price $1,000,000.

PORT IMPROVEMENTS

Dock, Saulte Saint Marie, Ont.—A. B. McLean & Sons, Saulte Saint Marie, plans dock for unloading sand and gravel. $60,000. Work will be done by day labor.

Pier, Oakland, Calif.—City of Oakland will build pier at the foot of Market street, by day labor under supervision of R. Beebee, harbor engineer. Price $200,000.

Pier Extension, Hermosa Beach, Calif.—Election is soon to take place on $500,000 bonds for numerous improvements, including extending present pier 300 feet into ocean.

Dredging, Manitowoc, Wis.—Contract for dredging 90,000 cubic yards in Manitowoc River was awarded to McMullen & Pitz, 915 Commercial Bank Bldg., at $0.305 per cubic yard.

Harbor Wall Repairs, Buffalo, N. Y.—Three breaks in the harbor wall south of the main entrance to Buffalo harbor are among repairs and improvements listed for this summer.

Dredging, Los Angeles, Cal.—San Francisco Dredge Company, San Francisco, Cal., was awarded contract for dredging about 670,000 cubic yards in Los Angeles harbor, San Pedro.

Wharf, etc., Norfolk, Va.—Contract awarded to Raymond Concrete Pile Company, 90 West street, New York, for 34 by 1,400 feet marginal wharf and pile jetty at Sewells Point, at price of $417,000.

Dredging, Los Angeles, Calif.—San Francisco Bridge Company, Nevada Bank Building, San Francisco, Calif., was awarded contract for dredging in Los Angeles harbor by U. S. Engineer, 725 Central Building, at price of $6,000.

Dredging, Chicago, Ill.—Fitzsimons & Connel Dredge and Dock Company, 10 South La Salle street, Chicago, was awarded contract for dredging in Calumet River, by U. S. Engineer, Room 1201, 537 South Dearborn street, Chicago, Ill.

Wharf, Midland, Ont.—Aberdeen Elevator Company, Midland, Ont., awarded contract for concrete wharf with 10 reinforced-concrete cribs and deck, to J. H. Tromanhauser, 69 Adelaide street, East Toronto, Ontario, Canada. Price $60,000.

Grain Handling System, Portland, Me.—Directors of Port of Portland, 67 Commercial street, Portland, Me., awarded contract for furnishing and installing grain handling system, to D. E. McIntire, Inc., 74 Broad street, Boston, Mass. Price $30,954.

Coal Pier, Virginia.—Virginian Railway will build a new coal pier at Seawall's Point terminals, more than doubling capacity of plant to dump coal. Expenditure will be about $3,000,000. Bids probably to be asked in near future. Preparing plans.

Harbor Improvements, Nassau, Bahama.—Taking bids for dredging channel and turning basin in harbor, 468,000 cubic yards of limestone and coral rock, 615,000 cubic yards of sand, low water depth 27 feet, tidal range 4 feet. S. H. R. Beard, harbor engineer.

Canal, Lake Charles, La.—Calcasieu Parish voted $2,700,000 bonds for deep water channel to the sea, including deepening and widening of Intracostal Canal between Calcasieu and Sabine Rivers, to depth of 30 feet and bottom width of 125 feet, also cut off near Lake Charles, and dredging Prien and Moss Lakes.

Dredging, Brooklyn, New York.—Sealed proposals were received by Superintendent of Public Works, Charles L. Cadle, at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, July 25, 1922, for dredging a portion of the Henry Street slip at Gowanus Bay, Borough of Brooklyn, New York City, N. Y.

Bulkhead Platform, New York.—A. N. Spooner & Son, Pier 11, North River, were awarded contract by J. H. Delaney, Commissioner of Docks, Pier "A," foot of Battery place, North River, for a bulkhead platform between foot of Stanton and East Third streets, at $98,400; dredging thereat, to Morris & Cummings Dredging Company, 17 State street, at $0.28 per cubic yard.

Canals Purchased by Government.—Purchase by the Federal Government of the Cape Cod and Dismal Swamp canals, now privately owned and operated, is authorized under a Senate amendment to the rivers and harbors development bill adopted recently by the Senate Commerce Committee. Under terms of the amendments the Government agrees to pay $5,000,000 cash and to assume bonds aggregating $6,000,000 face value for the Cape Cod Waterway. The Dismal Swamp Canal, which runs from Chesapeake Bay to Beaufort, N. C., would be purchased for $500,000 under the amendment.

GOVERNMENT WORK

Bulkhead Extension, San Diego, Calif.—Specification 4651—Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded contract for concrete bulkhead at Naval Base, San Diego, to Ross Contracting Company, Van Nuys Hotel, Los Angeles, Calif. Price $69,644 (120 days).

Seawall, Annapolis, Md.—Specification 4621—McLean Contracting Company, Fidelity Building, Baltimore, Maryland, was awarded contract for building seawall at Naval Academy, Annapolis, Md., by Bureau of Yards and Docks, Navy Department, Washington, D. C. Price, $14,350 (120 days).

NEW INCORPORATIONS

Gulf & Steamship Company, capital $75,000, chartered at Dover, Delaware.

The Augusta Navigation Company, capital $10,000, chartered at Wilmington, Delaware.

Observation Steamship Company, of Manhattan, capital $15,000, chartered at Albany; incorporators, E. F. Walker, H. F. Eckhardt and C. A. Polling.

The Pacific Fruit Transport Company, of New York, capital $15,000,000, chartered at Dover, Del., to operate steamships. Registrar & Transfer Company, Dover, Del., registrars.

The Shippers Exchange & Trading Corporation, of Manhattan, capital $100,000, chartered at Albany. Incorporators are V. and P. Giordano and C. R. Menille; J. M. Nolan, attorney.

American-Ukranian Corporation, of Manhattan, capital $50,000, chartered at Albany, New York, to do trade and transport business. Incorporators: W. B. Devoe, R. R. Maiden, H. S. Bracken.

Mexican Trading & Transportation Company, capital $100,000, chartered under Delaware laws, to engage in operation of boats. Corporation Trust Company of America at Wilmington, registrar.

The Backman Towing & Transportation Company, of Manhattan, capital $25,000, chartered at Albany, New York. Incorporators are: M. Anderson, E. Vorwerk and C. Backman; F. S. Johnson, 30 Church street, New York City, attorney.

Marine Equipment Company, Aberdeen, Washington, capital $1,000,000, organized for manufacture of ship furniture and furnishings. The new concern has purchased a tract of land east of Gray's Harbor and will shortly let the contract for the first unit of the factory building. New concern is only one of its kind in the West. Incorporators are: A. F. Gross, A. Bullinski, William Matis and John Trohimovich, of Aberdeen, and B. P. Kolowski, of Portland.

FOREIGN ACTIVITIES

Steamship Lines Established, Russia.—Odessa-Varna, Odessa-Constantinople, Odessa-Cardiff, and a further line between Odessa and an English port are to be established from Russia.

Tanker Launched, Caen, France.—Launching of what is said to be largest tanker in European continental yards took place at Caen, France. Vessel is 468 feet long, of 57 feet beam, with tonnage of 11,000. Named St. Boniface.

River Barge, Flardinsveld, Holland.—The Menvede Shipbuilding Company, late Van Vliet and Company, of Flardinsveld, launched a river barge of about 850 tons deadweight for Dutch owners, following which a keel for a sister-ship for the same owners was laid.

Monthly Passenger Service, France and Australia.—French-Australian Line has inaugurated new monthly passenger service between Marseilles, Melbourne, Sydney and Noumea, of New Caledonia. Company proposes placing seven or eight passenger and cargo steamers on route.

Steamship Launched, Holland.—Steamship Flandria, built for the Royal Holland Lloyd by Barclay, Curle & Co., Ltd., was successfully launched from the firm's Clydeholm yard, Whiteinch. This vessel, 470 feet long by 59 feet by 45 feet, with gross tonnage of 10,000, is for the Holland Lloyd's mail and passenger service between New Amsterdam and South American ports.

New Cargo Steamer, Holland.—The Kertosomo, the new Rotterdam Lloyd cargo steamer, built by Royal Shipbuilding Company de Schelde, Flushing, carries 3,000 deadweight tons on Summer freeboard. She is a shelter-deck steamer with forecastle, short bridge and cruiser stern. Principal dimensions are: Length, 473 feet 8 inches; breadth, 63 feet 4 inches, and depth to shelter deck, 41 feet.

Italian Shipbuilding Output.—During the first three months of the present year, the Italian Shipyards launched ten vessels of 13,743 tons. Of these five were passenger vessels of 11,788 tons, two sailing vessels of 560 tons, and five miscellaneous craft of 13,095 tons. During the same period keels were laid for one passenger steamer of 5,300 tons and one sailing vessel of 118 tons.

Steamer Launched, Belfast, Ireland.—The first-class passenger steamer City of Nagpur, designed and built for City Line fleet of Ellerman's Line, Ltd., was launched at yard of Workman, Clark & Company, at Belfast. The vessel is especially designed for passenger service between Great Britain and India and is twenty-first built by Belfast concern for Ellerman's. The vessel is more than 400 feet long and of 10,200 gross tons.

New Service, England.—November 4 will mark the beginning of a once-a-month service from British ports to Barbados and Trinidad by Elders & Fyffes, Ltd. It is proposed to arrange outward sailings in relation to sailings of the Harrison Liners Intaba and Ingoma, so as to give the West Indies a fortnightly passenger steamer service from the United Kingdom during the winter months. The Ingoma is to sail from Tilbury on or about November 18.

Scottish Shipbuilding.—During June the output from the Clyde shipbuilding yards aggregated 34,891 tons, compared with 40,476 tons in the same month last year. The half-year's total for 1922 is also down considerably, the figures being 162,216, as against 237,371 in 1921. From all the Scottish yards the June output amounted to 18 vessels of 38,240 tons, compared with 25 vessels of 42,651 tons during last June. The half-yearly total for all the Scottish yards amounts to 75 vessels of 180,270 tons, compared with 155 vessels of 275,370 tons during the same period last year.

Vessel Launched, Scotland.—Messrs. Ramage and Ferguson, Leith, have launched the steamer Tasso, built for the passenger and cargo trade between Hull and the Baltic of Ellerman's Wilson Line, Hull. The vessel is 344 feet long, 42 feet 9 inches in breadth, and 22 feet 6 inches molded depth. She will accommodate 45 first class and 362 third class passengers. The vessel is of cruiser stern type with extensive gear for rapid handling of cargo. Triple-expansion engines, having cylinders 21½ inches, 36 inches, and 63 inches in diameter respectively, and a stroke of 42 inches, will be provided by the builders. Two large Scotch boilers, working at a pressure of 225 pounds and fitted with forced draft, will supply steam.

Trial Trip, England.—Steel screw steamer Eastmoor, built by the Northumberland Shipbuilding Company, Ltd., Howden, to the order of the Moore Line, Ltd. (Messrs. Walter Runciman and Company, Ltd.), Newcastle, left the Tyne on her trial trip recently. The Eastmoor is 415 feet long by 53 feet breadth and 35½ feet depth molded. She will carry about 9,200 tons deadweight and has been built to Lloyd's highest class. Propelling machinery supplied by North Eastern Marine Engineering Company, Ltd. Triple expansion engines have cylinders 27, 45 and 75 inches diameter by 51-inch stroke, with three boilers, 15 feet 9 inches by 12 feet, 180 pounds working pressure, with Howden's forced draft. Trial was satisfactory, and mean speed of 11 knots was attained.

TRADE PUBLICATIONS

Heating and Power Plant Specialties.—The McAlear Manufacturing Company, 1920-7 South Western Avenue, Chicago, Ill., have ready for distribution a new 128-page catalogue, known as No. 27, which illustrates many new devices, including an individual temperature control valve, specialties for all power plants, vacuum and vapor heating systems, oil refining and water works plants, plumbing systems and marine service, together with illustrations showing their application and use. The individual temperature control valve is self contained and can be applied to any radiator, old or new, without additional piping other than the supply and return. When the thermostatic member is set for the desired room temperature, it automatically controls the opening and closing of the valve. The catalogue contains a very comprehensive detailed description of all specialties.

Vulcabeston.—The Johns-Pratt Company, Hartford, Conn., has just distributed its first catalogue which deals exclusively with Vulcabeston products, which include various forms of air pump, rod and valve stem, asbestos packings, pump valves, disks, bushings, rings, gaskets, washers, etc. Complete descriptions of the various products, together with price lists, are included in the pamphlet.

Seamless Steel Tubes.—The first of a series of illustrated bulletins, describing the manufacture of seamless steel boiler tubes, has been published by the Standard Seamless Tube Company, Pittsburgh, Pa. This first bulletin includes the manufacturing processes up to the point of piercing the solid billet and by means of illustrations gives an excellent idea of the equipment and methods employed. The second of the series of bulletins will be published within a short time, showing the tube mill operations, including the piercing of steel billets.

Fuel Oil Burning Systems.—A catalogue, consisting of three bulletins describing mechanical fuel oil burning systems and fuel oil burners in which the oil is atomized by low or high pressure air and steam, is being distributed by Schutte-Koerting Company, Philadelphia, Pa. The catalogue discusses thoroughly the installation, operation and maintenance of oil burning equipment, the characteristics, requirements and functions, as well as the relative merit of mechanical spray oil burners, the use of air control registers, oil pumping outfits and fuel oil heaters. Instructions are given for the general arrangement of steam boiler furnaces for burning oil.

Preventing Corrosion of Boiler Tubes.—A complete treatise in bulletin form on the prevention of corrosion in boiler tubes has been published by the National Tube Company, Pittsburgh, Pa. The subject of corrosion in general is treated, followed by details showing how this expensive item of locomotive boiler operation may be eliminated or reduced. This section includes methods of treating feed water, types of repairs and the like. The problem in the case of power and heating boilers is less difficult to remedy than for locomotives, being mainly a case of proper purification and softening of the feed water. In marine boilers the treatment of feed water is much the same as in stationary units. Authorities on the subject of corrosion have collaborated in preparing material for this bulletin.

Pneumatic Tools.—Two folders (special publication No. 686) have been sent out by the Chicago Pneumatic Tool Company, showing by illustration and description the great number of possible applications of the company's pneumatic and electric tools. These bulletins constitute a general review of riveting and chipping hammers, grinders, drills, air hoists, compressors, Semi Diesel oil engines and other products, with interesting notes on the history and development of the company and its devices, together with statements on the performance of many of them.

Flue Gas Analysis.—A new type gas filter for preparing flue gases for analysis, known as the double disk "Pyro-porus" filter, is described in a bulletin recently issued by the Uehling Instrument Company, Paterson, N. J. In addition to the details of the filter, an outline of its installation and uses are given, together with illustrations, showing its position in relation to the gas sampling pipe and boiler.

Armstrong Stocks and Dies.—Catalogue No. 17 has just been published by the Armstrong Manufacturing Company, Bridgeport, Conn., giving detailed descriptions and prices for Armstrong stocks and dies, water, gas and steam fitters' tools and pipe threading machines. A special section of the catalogue is devoted to details of new machines for threading and cutting pipe. These are built in various sizes for both hand and power drive.

Powdered Fuel Equipment.—A catalogue having as its object the explanation to prospective users of the advantages, construction and operation of the Grindle powdered fuel system has been published by the Grindle Fuel Equipment Company, Harvey, Ill. The complete system of stowing, drying, pulverizing, conveying and burning coal eliminates all handling of fuel by hand, shovels, wheel barrows, or industrial coal cars, also firing tools, grate bars, etc. The catalogue contains specifications and illustrations of standard equipment, but special types can be furnished to meet any particular condition.

Boiler Tube Cleaners.—The problem of eliminating the heat waste due to the formation of scale in boilers is dealt with at length in a catalogue sent out by the Liberty Manufacturing Company, Pittsburgh, Pa. Water turbine cleaners of various types, equipped with different style heads are described with the special uses for which they are best adapted. Pneumatic cleaners of high power in which steam can also be used are also illustrated and described. Mention is made of pneumatic cleaners for fire tube and return tubular boilers, arch tube cleaners and special cutting heads.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—S. M. Robinson. U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Asociation of Engine and Boat Manufacturers
29 West 39th Street. New York City.
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace. London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories. Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

Marine Engineering
and Shipping Age

Volume XXVII September, 1922 Number 9

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
L. S. BLODGETT, Associate Editor W. Z. GARDNER, News Editor

WE GUARANTEE that of this issue, 5,250 copies were printed; that of these copies 4,196 were mailed to regular paid subscribers, 110 were provided for counter and news company sales, 231 were mailed to advertisers, 29 were mailed to employees and correspondents and 684 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 49,500—an average of 5,500 copies a month.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

Prod the Party in Power Into Action

IF there is one fault of the American people that is more outstanding than any other, it is their lack of interest in their own Government. Intense attention to business, which has resulted in the development of the resources of this country far beyond that of any other has left them with little time or inclination to "Render under Cæsar those things which are Cæsar's." The payment of taxes is not a citizen's whole duty. He must be prepared to vote intelligently and to help form a public opinion that will in no wise leave Congress in doubt as to the wishes of their constituents.

It is a favorite pastime to criticize our legislators particularly along the line of inaction, but, where there are so many divergent interests, it cannot be expected that any set of men can hope to read public opinion correctly, if America is to continue apathetic on questions of vital importance.

There can be no reasonable doubt that the vast majority of our people want to see our merchant marine firmly established and developed. A good many, however, are not convinced that a subsidy is the only way in which this can be accomplished. They know in a general way that our ocean-going shipping was practically negligible in 1914 and that later it was necessary to spend enormous sums of money in hurriedly constructing vessels to take the place of those being sunk by the German submarines.

The necessity for a merchant marine was apparent then but the reason why there was not an adequate number of American ships and the reason why millions of tons of our vessels are tied up today has really never sunk in because the interests who handle this business have taken good care to confuse the issue.

It would seem that our experience in the last sixty years of trying to build up and operate a merchant marine without Government aid would be convincing enough. It would seem that with fully one-half of the world's idle tonnage American owned while only one-fifth of the world's tonnage is under the American flag would show us that we are not getting anywhere near our share of the world's commerce. But this is not sufficient and, if the American people do not take enough interest to demand and insist that their representatives grant National aid of a nature similar to that which has been recommended by the best experts in the country, we will never have a merchant marine.

The subsidy is the answer until someone can show another way to make up the differences between the wages of the shipyard workers and the operating costs over that of other countries. The opponents to the shipping bill in Congress are not anxious to bring the matter to debate. They would far rather delay action on the bill and allow it in that way to die a natural death. But, if public interest could be aroused sufficiently to demand a decision on this matter, at this session of Congress, we need have little fear for the future of our merchant marine.

Standards for Export

ACCORDING to a report from the American Engineering Standards Committee, Germany is trying to impress its standards on all import countries. "The day may not be far distant," it is stated, "when American manufacturers will receive inquiries from oversea countries to furnish goods according to the German national standards, and it behooves us to plan in time to meet such conditions."

As an instance of how a standardized industry could be made of great value in securing foreign trade for Germany, a case is cited where "nineteen German manufacturers and one Swedish manufacturer were executing an order for seven hundred locomotives for Russia, all of the same design. Every part in every one of them was being made interchangeable with the corresponding part in all the others, all parts having been manufactured to the same fits and tolerances." This feature, it is claimed, "will have the great advantage of permitting the Russian railroads to use

any disabled locomotive as a store of spare parts for all the others. In one case a locomotive was assembled from parts machined in twenty different shops, with no more difficulty than a locomotive which was built complete in one shop."

Of course the inference is drawn that any future orders for locomotives from Russia will be strictly according to the design for these seven hundred engines which are built to German specifications and therefore German manufacturers will have a great advantage over those of other nations. It is not clear, however, what action should be taken by America to prevent the loss of foreign trade through Germany and England forcing their standards on other countries.

This much, nevertheless, is certain that we have the largest domestic market of any country to standardize for. Our export surplus which is claimed to be not over 15 or 20 percent on the average has all the benefit of quantity production and it is where mass production has been taken advantage of, as in the case of typewriters, harvesting machinery and automobiles, that we have achieved the greatest success in our foreign trade. It is our opinion that more could be accomplished for America at present by evolving some method of financing foreign trade but, at the same time, we should keep abreast of both England and Germany in the prevention of waste by standardization.

Shall We Depend on the British?

It has been stated that a much deadlier poison gas is now known than any which was used in the great war and that it can be put up in spherical glass containers of about 4 inches in diameter. One aeroplane could carry a sufficient number of these gas bombs to completely destroy all life in a city for the gas would remain in the narrow streets for days and would quickly permeate into cellars and subways.

We also learn that incendiary bombs of small compass but containing thermit have been invented. Anyone who has seen this substance used in welding operations will realize that it will burn its way through steel and cannot be extinguished. A shower of such instruments of destruction would be a catastrophe that Sodom, Gomorrah, Pompeii or Mt. Pelee could not eclipse.

Right here is the greatest argument for a ship subsidy. If such things are possible, we should not only have as good a Navy as any nation but a real merchant marine with its quota of fast passenger ships capable of making a speed of over 20 knots and so designed that they can be quickly converted to aeroplane carriers. We should make it certain that any fights in the future shall occur away from our shores and the only way to do this is to provide a sufficient subsidy to secure the construction and operation of the type of vessels that will not only help us commercially but also prevent terrible destruction in case of war.

Joseph W. Powell says that the Washington Conference clinched the supremacy of British sea power for the next decade. He is absolutely right, for England would still be mistress of the seas if every warship was sunk because her merchant marine and naval bases are superior in number and strength to those of any other nation.

England has constructed since 1905 twenty-seven passenger ships capable of making over 20 knots speed. All of these ships are over 10,000 gross tons. We have one vessel of 8,225 gross tons having a speed of 20 knots.

If we are going to have the protection of such vessels, they must be constructed, for they do not exist. The Shipping Board with all its surplus vessels has none. But, if a reasonable subsidy is provided, men like W. A. Harriman stand ready to do their part and this fact has been proved in Mr. Harriman's case by the money that he has already invested in American shipping.

Vote on Subsidy Bill Deferred

President Harding has agreed to a postponement of action on the Administration shipping bill until after the November election. But in doing so he has made it clear that he is still very much in earnest about the passage of this measure and that he still thinks it so important to our commercial prosperity and so essential for our national security that he sanctions the delay only because he fears that the attention of Congress cannot be riveted on the bill at this time.

Had it not been for the extraordinary industrial situation, namely, the coal and railroad strikes, which have taken practically his whole attention, the President undoubtedly would have invited conferences of the Congressional leaders to iron out the differences of opinion that have arisen in regard to the inforcement of prohibition on American passenger ships and other matters. But he believes that until a way can be found to straighten out these difficulties, so that they will meet the approval of all supporters of an American merchant marine, it would only jeopardize the bill by pressing for immediate action.

We are sorry that we cannot agree with the President's opnion that delaying action will help matters. We believe that the longer a vote is deferred the greater will be the opportunity for the alien propagandists and pacifists who make light of the necessity for a merchant marine as an auxiliary navy to defeat it. What a triumph it would be for those who are willing to place the United States in a position of dependence on the Navy and merchant marine of Great Britain to put American shipping in a position that it could take only such commerce as the other nations were willing to give it!

The President has intimated that should it become necessary to call a special session of Congress in order to get the subsidy bill written into the statutes he would do it. Let us hope that he meant what he said and that a special session will be called immediately after the election and kept in session until action is accomplished. History shows no example of a successful commercial nation that depended upon other powers for the carriage of its merchandise or for naval protection. If the subsidy bill is not enacted, American ships cannot compete with those of other nations and our prestige as a country will surely suffer.

No matter which way the election goes there will still be the same Congress during the short session commencing December 4. Therefore, President Harding with his unprecedented Republican majority in both houses of Congress ought to be able to make the subsidy bill a law even if a Democratic landslide occurs.

Boom for Shipyards If Subsidy Bill Passes

Cost of Subsidizing Ships Should Be Considered as Investment Paying Dividends in Increased Trade

By Hon. William M. Calder*

I ASSUME that no American citizen would oppose the creation of a great merchant marine. I know that all our people would like to see the ensign of their country floating at the masthead of ships in all ports of the world. But while it is pleasing to think of this, we must bring ourselves to the realization that its consummation can come only when we shall have adopted the means necessary to translate it into actual achievement.

It is a strange fact that some of our citizens who desire that America shall be supreme in the peaceful navigation of the seven seas would refuse to give their assent to the means through which this could be accomplished.

In reality the cost of the subsidization of the merchant marine would amount to nothing, for the benefits resulting from such an enterprise would be so great as to make the "investment" look trivial in the extreme. It is an investment which will pay enormous dividends in the shape of increased trade.

To embark upon an enterprise such as the President has already outlined would be to commit the country to an industry which before very long would become almost incalculably productive.

American shipyards would become more active than any of the plants on the Clyde, and soon we would have an army of trained and well paid mechanics who would rival anything that Scotland, England or Wales has ever produced.

Many of our citizens deplore the fact that less than twenty-eight percent of our commerce is carried in American bottoms, but when it is suggested that practically all American goods can be carried in American ships if we will only be wise enough to equalize the difference between the freight costs in foreign bottoms and American ships, they hesitate to take the steps necessary to assure such equalization.

They balk at the word "subsidy." Some of them even go as far as to say that it is synonymous with the term "graft." In reaching this conclusion they are deluded by an illogical method of thought. They forget that if their desires for an American merchant marine are ever gratified we must either pay American seamen the wretched dole that is given by European and Asiatic countries or give the American shipowner the benefit of Federal aid.

No one wishes to see the standard of living for American seamen reduced to the low levels of European and Asiatic standards. We all want American workers to be well paid, well clothed, and well fed. We want not only to build and operate a great merchant marine, but we want the ships manned by robust, wholesome men who are paid wages sufficient to enable them to lay up something against that time when adversity may overtake them. In other words, we desire that the American citizen who makes his living at sea shall enjoy the same benefits of his citizenship as his more numerous countrymen on land. It is worth paying a subsidy if only to assure the employment on American ships of men who truly represent American ideals. We want no impairment of American manhood whether that manhood is employed in the Arctic Ocean or in the congested cities of our great country.

Some of our farmers have criticized the proposal to build and operate a great merchant shipping industry through the temporary assistance of the government; and yet agriculture will be the chief beneficiary of such an arrangement. What farmer is there who does not desire that American fruit, American meat, American wheat, American corn and American cotton shall be carried to the ports of the world in American ships? Through the assistance given by the government, American ships will be able to enter into successful competition with foreign vessels and new and extensive markets will be found for American farm products.

Moreover, a merchant marine in time of war is an absolute necessity. The greatest navy that was ever built by any nation that ever existed, would be helpless without supply ships. The fighters must be fed. God forbid that we shall ever have another war; but if it should come, let us not be caught in the condition of unpreparedness in which we were found when the late struggle was forced upon us. I refer of course to our condition of unpreparedness in relation to necessary merchant ships.

It is humiliating to recall the fact that two-thirds of our soldiers were transported to France in British vessels. Our Navy convoyed them, and without the loss of a man, but we had to depend upon our chief associate in the war to get our men to the French front.

If the Germans had been successful in their submarine warfare, we would have been left with a great and efficient Army which because of the lack of necessary transportation facilities could not have taken, for a long time at any rate, an effective part in the terrible conflict. No doubt American genius, loyalty, patience and courage would at last have found a way to circumvent the enemy. But why allow ourselves to get into a condition where in time of emergency we are compelled to rely upon the shipping resources of another power?

I regard the general proposition of a ship subsidy plan in much the same light that I do the principle of a tariff to protect our American industries. Let us have a great merchant marine and be ready, as good and progressive American citizens, to pay the cost. The price will be comparatively small, while the ultimate returns will be incalculable.

* United States Senator from New York.

Ship Subsidy Vital to United States, Says Harriman

W. A. HARRIMAN, chairman of the United American Lines, declared recently in a newspaper interview that the position of American shipping is precarious. World trade is badly depressed, he said, and ocean rates are low and operating expenses high. Foreign shipping suffers from this condition, but American shipping suffers more because it costs more to run boats under the American flag, and because we have had less experience in world trade. The next five or ten years will be highly competitive ones and will test the strength of the shipping organizations of the various countries. Those which cannot compete will be forced to quit. Under these circumstances I consider the ship subsidy question a vital one for this country. If Congress sees fit to pass the subsidy bill, thus giving American shipowners assistance which is needed to see them through this critical period, I will then feel confident of the future.

Failure of Shipping Bill Means Government Ownership

If Merchant Marine Is Not Established Through Pending Legislation, It Will Be Maintained by Shipping Board

By "Old Scotch"

"WE will fight it out on this line, even if it takes all summer" was a declaration of General Grant in his campaign before Richmond. History records that it took him more than "All summer," but that eventually he won out.

The campaign for the subsidy bill seems to have resolved itself into a do or die proposition, and all the proponents of the pending legislation need is some of the indomitable spirit of Grant. Our cause is a just one, and notwithstanding the dismal outlook, at this writing, for legislation of any kind, we can console ourselves that the outlook is no more discouraging than that which faced General Grant, or similar outlooks of various other persons and classes in the world's history, who have accomplished great things by knowing that the causes which they espoused were righteous ones, and who had the will and determination to win because of that knowledge.

People generally have no use for "quitters," and, while I hesitate to place some of the proponents of the subsidy bill in that class, the fact remains that some of our number seem to be getting a little weak-kneed, to place it mildly. After all is said and done, what finite thing has developed to make any one weaken? The opposition to the bill in Congress is not based on the broad principle of a merchant marine or no merchant marine. Opponents have merely criticized certain phases of the bill, and made mountains from mole-hills of things which in a close analysis are more or less trivial. Such propaganda as has appeared in unfriendly newspapers is plainly based on the efforts of foreign rivals to defeat the bill and is disguised by American writers, who are not conversant with the subject, so thinly as not to hide its origin from readers who know the subject in all its phases.

Shall It Be Government Ownership?

There is one outstanding feature of the entire controversy that is so plain that it can be discerned by any one of fair intelligence and unbiased judgment, and that is, the American people at large are determined to have their own merchant marine. If it is not to be established through the medium of the present legislation before Congress, which represents the consensus of opinion of those best informed on the subject, there is little doubt but what it will be maintained as, at present, under Government ownership. The most bitter opponents of the subsidy bill have never questioned the idea of our having an American merchant marine, and no sentiment throughout the country has developed against that fundamental idea. So the alternative is, if this subsidy bill does not pass, we will find ourselves so firmly committed to Government ownership and operation that we cannot extricate ourselves from that much to be dreaded state of affairs.

There is in this country today a deep-seated leaning towards Government ownership of common carriers on land as well as on the sea, which should not be overlooked by those opposed to this semi-socialistic doctrine. Let our foreign rivals, who are trying their best to defeat the present bill, take heed of this warning. The very thing most dreaded in maritime nations abroad is that Uncle Sam will continue to operate his own merchant ships, if we can believe the editorial comments of leading journals. Hence, if by any chance they can succeed in defeating the subsidy bill, the avowed object of which is to place our merchant shipping in private hands, they will, beyond peradventure of a doubt, be confronted with a fixed determination on the part of this Government to continue in the shipping business as at present. The present Shipping Board has made gigantic strides in clearing up the fearful muddle in which our shipping was plunged during and just after the great war. Inefficiency, extravagance and downright crookedness have been almost entirely eliminated, and today the Shipping Board fleet is being operated almost as well as it could be in private hands.

Shipping Board Management May Appear Desirable

No one is making any money out of shipping at this time, because conditions of world commerce were never before at such a low ebb. Conditions cannot and will not long remain in this unusual state of depression. If freight rates, now lower than they have been in years, should advance to anything like normal, in all probability the books of the Shipping Board would show a small profit to the Government instead of the gradually decreasing losses at the present moment.

Efficient Government ownership and operation by the United States would be very difficult to beat by any foreign competition. Federal enterprises would not be compelled to show any financial profit, which would remove almost the entire handicap which surrounds private ship operation under Government ownership. The capital is already provided by the actual possession of the necessary ships, the cost of which, in the minds of the public at least, has already been charged off as a war cost. Depreciation charges just sufficient to provide the necessary replacements of more modern and efficient ships, of a number to equal the actual needs of transacting only sixty percent of our water-borne foreign commerce, the aim of our present shipping ambitions, would not be a great deterrent in a Government-owned merchant fleet. Honest and efficient management in the purchase of fuel and supplies, and the making of repairs, for such an enormous fleet such as we already have, under the present efficient Board, would be a great handicap for foreign competitors whose merchant fleets are divided up among innumerable private owners.

Big Undertakings Our Specialty

When it comes to quantity production and management the United States has always been supreme in any competition. The American mind seems to grasp great undertakings much better than any other, because we are all trained to think and act in large units. Nearly every one of the great basic industries upon which mankind's wants are filled are found in this country in a predominating state of development. Shipping, in the last half century, is the one outstanding exception to this general rule. When we start in to make this a success comparable to other great basic industries in which we are paramount, whether it be in private hands or by force of circumstances it is placed in public control, we can and will assume our rightful position.

We demonstrated what we could do in this line during the late war, when, waking from a somnolent state of our shipbuilding industry, we applied our national characteristics of energy and determination and in three years assumed the leadership in the world for ship production. Of course, due to the necessities of the world-wide strife, this great produc-

tion of ships was brought about solely by the Government, but it shows what we can do with our enormous resources and capabilities for tackling large jobs.

THE DIE IS CAST

There are but a very few Americans conversant with shipbuilding and ship operation who want to see our Government remain in the ownership and operation of merchant shipping. But the die is cast, the American public is awakened to the absolute necessity, for purposes of trade as well as of defense, of American control of a sufficient merchant marine for our needs in peace and war. If the opponents of the pending shipping bill can by taking advantage of legislative entanglements and political exigencies succeed in defeating the subsidy bill now before this Congress, there is but one inevitable alternative and that is a continuation of existing publicly-owned and operated shipping. The relief to the taxpayers, which is bound to follow improved conditions in ocean shipping returns, will convert many citizens to the continuation of the Governmental control of sea transportation.

It is needless to dwell on the tremendous effect such an unfortunate conclusion would have on that ever-present menace of Government-owned and operated railroads, and the eventuality of Government control of all means of transportation. The present deplorable mix-up between railroad owners and employees is daily adding fuel to the flames, and the long-suffering public may "first pity, then endure and then embrace" the temptation of what they may conclude is, after all, the only solution of transportation ills on land and sea.

PRIVATE OWNERSHIP DEPENDS ON SHIPPING BILL

It therefore behooves everyone of us who is not in favor of Government ownership of the means of transportation, and fortunately it is believed we are still in the great majority, to lend all aid to the passage of the subsidy bill, the only known means of placing our shipping in private hands at the earliest practicable time. The subject has been thrashed over and over for years by the best talent in the country, and the predominance of opinion, by those qualified to know, is that the bill as now drawn is the only method of accomplishing this aim. Discriminating duties, such as are now authorized by law, might have been the proper means for accomplishing the end, but that seems to be impossible of enforcement, so we will have to dismiss it.

The writer still believes that the administration bill can be enacted into law, despite the seemingly impossible tangle in which all legislation at this time appears. Worse predicaments than the present one in Congress have been ironed out by force of public sentiment. The subsidy bill should be passed before election day. Those in charge should not listen for a moment to the blandishments of half-hearted supporters nor to the threats of whole-hearted opponents. If action is postponed until "next session," as is now being advocated, the bill will fail and, failing in this Congress, a great step will have been taken towards Government ownership for sea and land transportation.

Foreign Dread of the American Shipping Bill

America, with Harbors Fronting on Two Great Oceans, Will Inevitably Become Greatest Sea Carrier, If President Harding's Bill Is Enacted by Congress

By Winthrop L. Marvin*

It is no disparagement of the pending shipping subsidy bill for the advocates of the measure to make it clear at the outset that they cherish no delusion that a great merchant marine can be created by the sheer force of National aid or subsidy alone. Encouragement to ocean shipbuilding and navigation is the universal policy of all nations having a sea front and a commerce. But it is not to be pretended that the amount of the National aid or of the subsidy is an unvarying measure of success attained. This success depends upon the native aptitude of each nation for maritime adventure and the degree of circumstances or conditions favoring it.

The British, pioneers in subsidies (to their great National mail lines), have been brilliantly successful. So has another insular race, the Japanese. This is not primarily because the British and Japanese happen to dwell on an island or islands. It is rather because both Great Britain and Japan are enterprising commercial and maritime peoples, having aspirations and resources for wide-flung seaborne trade.

These two nations were predestined for success upon the ocean. They have won that success with the help of persistent expenditures for the direct encouragement of their steamship services, and they have attained their object at no excessive cost. In their cases National aid, inherent aptitude and trade opportunity have coincided in a remarkable degree.

Take another example—that of France. The French have expended far more money in National aids and subventions than has Japan—partly because they began their policy of aid long before Japan did—in 1881 instead of in 1896. For a long time success with France hung in the balance. Her merchant tonnage did not increase at once, as Japan's did. This was in part due to imperfect methods of detail in French laws bestowing subsidies and subventions. But it ought frankly to be recognized that it was due also to the fact that France was not so distinctively a maritime nation and an expanding commercial nation as Great Britain or Japan, or, as we might well add, America.

France in the seventeenth and eighteenth centuries disputed with Great Britain the mastery of the seas. But France in the Napoleonic wars was beaten at sea as she finally was on land, and forced to a subordinate position in her navy and her merchant shipping. The French genius shone best in other lines of effort than in shipbuilding and navigation in the nineteenth century. France's population, moreover, became stationary and even declined, so that the nation lacked the vital stimulus of colonial expansion. Moreover, the products of French industry, while of high intrinsic value, are and have been of relatively small volume, thus failing to furnish the bulkier cargoes for the outward voyage. Further, France, since the war of 1870-1871, had no super-abundance of coal and steel for shipbuilding.

PERSEVERANCE BRINGS SUCCESS

Thus, because of basic reasons with which subsidy had nothing to do, the foes of National aid for some years after

*Vice-president and general manager, American Steamship Owners' Association, New York.

1881 were encouraged to point to France as an example of the ill-success of a subsidy system. But no thoughtful advocates of a policy of National aid by subsidy or in other ways had ever assumed that all nations that tried subsidy would succeed in equal proportion to the amounts expended. There is nothing magical in a shipping subsidy itself. To achieve the maximum results it must be joined with other factors of aptitude, enterprise, zeal and favoring conditions. France happened to face conditions many of which were unfavorable, and, therefore, because of the imperfection of her earlier subsidy laws as well as because of natural handicaps already outlined, her progress in the rehabilitation of her merchant shipping under subsidy was for a long time slow and discouraging.

But the French, a brave race, a gallant race, a patriotic race, steadily persevered. They revised and re-revised their shipping laws, attempted new expedients, ceased to favor sail ships at the expense of steamships, and generally learned wisdom from experience. As a direct result, French merchant shipping, which even with subsidy had increased only from 919,298 gross tons in 1880 to 1,350,562 gross tons in 1900, soon began to show substantial progress, gaining steadily from 1,350,562 gross tons in 1900 to 2,319,438 gross tons in 1914, the year of the world war.

Result Is Experienced Ship Operators and Shipbuilders

Even before the world war, France was indisputably becoming again a great maritime nation. In the four years of the world war 921,636 gross tons of French shipping were destroyed by the enemy mines and submarines. But the French system of National aid had developed excellent shipyards and a strong and capable body of merchant shipowners and operators—so that with the continued aid of the government the French merchant marine had more than made up its war losses up to a total of 3,245,194 gross tons in 1920.

That is to say, in spite of difficulties and discouragements under an improving policy of constructive National aid, the French subsidies had succeeded, as British subsidies and Japanese subsidies had succeeded, in making the French merchant flag a power on the ocean.

Those foes of National aid to shipping who had scoffed at France as an illustration of the "futility" of subsidies were utterly discomfited in the long run—precisely as had been those who in the United States fifty years ago had scoffed at any hope of success from the high protection to manufacturing, under which the United States has now become head and shoulders the greatest manufacturing nation in the world.

Now what had enabled France to realize her ambition for a merchant marine was not the subsidy alone, any more than it was the subsidy alone in the case of Great Britain or Japan. It was subsidy matched by high endeavor and sustained by the native producing and commercial resources of the nation.

An Impressive Lesson For America

These facts of recorded history have their impressive lesson for our America. National aid to shipping will succeed in the United States, as it has succeeded in Great Britain and in Japan, first because the American race, as its whole history proves, is by instinct and tradition a maritime race —judged by its achievements before 1861 the most daring and efficient maritime people the world has ever known. Moreover, the Americans, perhaps beyond all others an industrial and commercial people, are exporting today a greater bulk and value of home produced goods than any other nation—and our overseas trade is only as yet in its infancy.

There are in America the goods to carry and the genius to build and sail the ships to carry them. There is a rapidly expanding population to furnish shipbuilders and seamen to convey an ever-increasing surplus of products to foreign lands. Judging by the experience of Great Britain, of Japan and of France, the United States, once it bestows National aid on its shipping as a half century ago it bestowed most liberal National aid on its manufacturing, will succeed far beyond the measure of Great Britain or Japan or France, and will become, before many years have flown, the greatest merchant shipping power in the world, just as it will be incontestably the first and foremost of industrial and commercial nations.

Opponents Must Lack Common Sense

A few years hence there will be widespread wonder in this country that any men calling themselves Americans should have ever made the piffling objections that some of our public men are making to the enactment of President Harding's shipping bill. There will be amazement that any Senators or Representatives, even of States far inland, should have failed to visualize the tremendous opportunities which National aid to shipping opens not to shipping alone but to the manufacturing and the agriculture of America. Those who in the halls of Congress are now contending that America needs no ships and that subsidy will fail to give her ships, are going to be looked on presently like those other wiseacres who disputed with Columbus and insisted that he could not sail around the world to the Indies because the world was flat!

Let this fact be emphasized again and again, that it is only in the United States that there is any debate over National aid by subsidy or in other ways to shipping. When the British Parliament bestowed the hugest subsidy of all to the Cunard Line when it loaned twelve million dollars of money for the building of the *Mauretania* and *Lusitania* and provided a twenty-year subsidy by which the loan might be repaid, there were no protests from agricultural statesmen of the inland counties. The vote of Parliament was hearty and unanimous. Japan, since the war, has confirmed her long-time policy of shipping subsidies. France and Italy are doing the same. The Scandinavian countries are studying the best means of reinvigorating their merchant navies.

And they are all doing this without sectional or factional division. It is only in America that the appeal to sectional or party spirit is heard against National aid to the National flag in the most intensely competitive of international industries.

Anti-Subsidy Propaganda

Britons, of all kinds and degrees, as Senator Ransdell and other American public men have lately shown, are carrying on a vociferous campaign against any encouragement to American shipping. Tories, Unionists and Liberals, through their public press, are unanimous in the demand that the passage of President Harding's shipping bill must be prevented by the British government. They are appealing for the defeat of this bill to what they describe as the "pro-British party" in America. And the same spirit of violent antagonism to American aspirations on the sea apparently pervades the people and the press of all other maritime nations.

A minority report from five minority members of our House Committee on Merchant Marine and Fisheries proclaims that the proposed shipping bill will not create a great merchant shipping for America. On the contrary, all American maritime men and the Senators and Representatives from maritime States proclaim that this bill *will* create a great merchant shipping. With this informed majority of Americans, all British, Japanese and other foreign shipping men thoroughly agree. These foreign observers who know trade and who know ships are frank to confess that the American shipping bill is a tremendously formidable measure—that it will most certainly give America the mastery of the seas—and that all foreign interests must unite to obstruct and to kill the bill as soon as possible.

These foreign antagonists of ours see far more clearly than some of our own people that America, by her proved genius for shipbuilding and navigation, her unmatched commercial resources and geographical position, with her deep harbors fronting on the two great oceans of the world, will inevitably become the greatest of sea carriers if President Harding's plans are fulfilled by the American Congress. All the world sees this but some of our own far Southern and Western inlanders—men to whom the glorious facts of our maritime history are as if they never had been written.

Here, then, is the extraordinary situation as the time nears for active consideration of the American shipping bill—our foreign competitors frankly fearful of its enactment because they are certain that it will make America the first maritime power of the world; all Americans who know ships and sea trade absolutely agreeing with this opinion—and a minority of inlanders in our own country blindly striving to thwart America's destiny. Is not this a spectacle for gods and men!

A quarter of a century ago a similar spectacle might have been witnessed with regard to the American navy. Foreign governments frankly disapproved the building of the first White Squadron. Those foreigners objected strongly to the presence of American battleships and cruisers protecting American commerce on the highways of the world. A great many inland Americans also objected. Those first naval appropriations for a new steel fleet were passed on a narrow division, with the utmost difficulty. Yet where would we have been without this war fleet in our conflict with Spain? That was a revelation that converted the West and the South to the enthusiastic support of the American navy of today. And in the immediate future that is what our experience is going to be with the American merchant marine.

Latest Developments for American Marine Week

Prominent Speakers to Address Combined Gatherings of Maritime Associations—Model of Leviathan to Be Exhibited

As the number of days in American Marine Week, which will be celebrated at the Grand Central Palace, New York City, November 4-11, will be far too few to accommodate meetings and conventions for all the associations taking part, it is planned to hold combined gatherings at which prominent speakers will talk on the practical problems of American shipping.

Very interesting papers of this nature have been presented at the annual conventions of the National Merchant Marine Association in Washington and it is believed that the auditorium at the Grand Central Palace will be taxed to its capacity to accommodate all the members of the various maritime associations who will want to hear these instructive addresses.

Naval Architects' Convention November 8 and 9

Two days will be required for the reading of the technical papers at the annual meeting of the Society of Naval Architects and Marine Engineers. Professional men both here and abroad are interested in the subjects presented and the ensuing discussions because they represent the best that America has to offer in the science of naval architecture and marine engineering. The list of the papers and their authors has not as yet finally been determined but it is understood that the selection will be made about September 1.

Likewise neither the selection of the prominent speakers, who will address the practical meetings, nor their subjects can be definitely stated this month. They will include, however, prominent Government officials, Congressmen and the leaders of the maritime organizations. A number of these gentlemen have already signified their willingness to speak and the publicity value of their services to the American merchant marine cannot be over estimated.

Steamship Owners' Day

The quarterly meeting of the American Steamship Owners' Association will be held on Monday, November 6, which will be called "Steamship Owners' Day." This meeting will probably be held in the morning, as usual, and in the offices of the association, which will leave the afternoon and evening free to such of their members as care to attend the meetings at the Grand Central Palace and inspect the marine exposition.

Maritime Association

Mr. F. B. Dalzell, Jr., has been appointed chairman of a committee to represent the Maritime Association during the week. At this writing the other members of the committee have not been selected. When interviewed by a representative of Marine Engineering and Shipping Age, Mr. Dalzell stated that they expected to have a very fine exhibit in their three booths at the exposition. They will also be represented by one or more speakers.

New York Tow Boat Exchange

Mr. Dalzell, who is also connected with the New York Tow Boat Exchange, has secured from that organization the privilege of showing a valuable moving picture film of towboating in New York harbor. This film will be exhibited on several occasions during the week in the auditorium of the Grand Central Palace.

A Joint Meeting

Under the auspices of the Ocean Officers' Conference, composed of captains, mates, engineers and radio telegraphers, a joint meeting will be held in the auditorium of the Grand Central Palace. The exact date for this meeting will be announced later.

The Marine Exposition

One of the star features of the marine exposition will be a gigantic *Leviathan* exhibit, the equal of which has never been seen in this country before. Through the combined efforts of the Newport News Shipbuilding and Dry Dock Company and the American Marine Association arrangements have been made with Gimbel Brothers to exhibit the original model of the *Leviathan* at the exposition.

This model is the original model which was owned and built by the Hamburg American Line. It is said to be some 38 feet in length and without doubt it is the largest and finest ship model in the world.

Purchased by Gimbel Brothers

This model and a complete set of the original plans of the *Leviathan* were purchased in Germany by Gimbel Brothers who are the contractors for furnishing the stewards' equipment on the *Leviathan*, which is now being reconditioned at the Newport News Shipbuilding and Dry Dock Company for the United States Shipping Board.

This exhibition of the model at the Grand Central Palace, November 4-11, will be the first time it has been shown in this country. The model was recently shipped from Germany at great cost and arrived in New York on August 21, 1922. In addition to the fact that the model will show

all the details of construction to scale, it will be the first opportunity for the public to see what the underwater portion of the vessel really looks like.

Equipment Display

The gigantic *Leviathan* exhibit has been so planned that any concern furnishing material for the reconditioning of the ship may suitably display their part in the reconditioning of the world's greatest vessel, by exhibiting in this section.

Full particulars concerning arrangements to exhibit may be obtained from the office of the American Marine Association, Inc., 15 Park Row, New York city, telephone Barclay 5458.

Transportation Rates.

Mr. John A. Heuse, eastern manager of the Northern Fire Apparatus Company, has been appointed chairman of the Transportation Committee. He has started negotiations with the railroad men and the Trunk Line Association to secure reduced fare rates for all the members of the various maritime associations that take part in American Marine Week.

As soon as the details of just what formalities persons coming to New York to attend any of the functions must comply with are obtained they will be published. Instructions will be given about purchasing tickets and validating the same upon arrival at New York so that a half fare reduction may be secured. It will be a big saving to those who come from a great distance if the Trunk Line Association grants permission to the railroads to sell half fare tickets from New York to the home destination and would amount to 25 per cent of the entire railroad fare.

Sightseeing Trips.

It will also be the function of the Transportation Committee to arrange for comprehensive sightseeing excursions so that those who attend the exposition may have the opportunity of visiting all the points of special interest in and about New York.

A consolidated ticket office will be maintained at the exposition in order that all delegates may procure both railroad and Pullman tickets and make all steamboat reservations for the return trip without leaving the building.

Increased activity is being shown in requests for exhibit space at the exposition. Shipbuilders, repair and equipment companies from all sections of the United States will be represented at the show, according to present indications, and the exhibits being planned give promise of being more unusual and interesting than ever before. Steamship owners and steamship operating companies are also exhibiting a keen enthusiasm. The scope of the forthcoming exhibition is daily growing more widespread and the list of companies who will take part is being constantly added to.

The official allotment of space and booth numbers thus far made is as follows:

Booth No. 2—American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
3-6—General Electric Co., Schenectady, N. Y.
7—C. H. Wheeler Mfg. Co., Philadelphia, Pa.
8-11—Pneumercator Co., New York, N. Y.
12—Victor Eng. Co., New York, N. Y.
13—C. H. Woolsey Paint & Color Co., New York, N. Y.
15—Peabody Engineering Corp, New York, N. Y.
16—Texas Co., New York, N. Y.
17—McCormick, McPherson & Lapham, San Francisco, Cal.
19—American Steel Foundries, Chicago, Ill.
21—Ashton Valve Co., Boston, Mass.
22-24—Sperry Gyroscope Co., Brooklyn, N. Y.
25-28—Coffey Engineering Corp., New York, N. Y.
29—W. & J. Tiebout, New York, N. Y.
30—Pantasote Co., New York, N. Y.
31—Lee & Simmons, Inc., New York, N. Y.
32—Marine Review, Cleveland, O.
33—Hyde Windlass Co., Bath, Me.
34-35—Brunswick-Kroeschell Co., New Brunswick, N. J.
38—Crandall Engineering Co., East Boston, Mass.
42—The Babcock & Wilcox Co., New York, N. Y.
44—Underwood & Underwood, New York, N. Y.
45—Valentine & Co., New York, N. Y.
46—Port of New York Publicity Co., New York, N. Y.
47—Keasbey & Mattison, Ambler, Pa.
51—Marine Engineering & Shipping Age, New York, N. Y.
52—Mercantile Specialties Co., New York, N. Y.
53—Ellcon Co., New York, N. Y.
55—Northern Fire Apparatus Co., New York, N. Y.
57—Coen Company, San Francisco and New York, N. Y.
58—National Malleable Castings Co., Cleveland, O.
59—Scovill Mfg. Co., Waterbury, Conn.
60—The Griscom-Russell Co., New York, N. Y.
63—Diamond Power Specialty Corp., Detroit, Mich.
64—Asbestolith Mfg. Co., New York, N. Y.
65—Row & Davis, Engrs., Inc., New York, N. Y.
66—The Superheater Co., Chicago and New York, N. Y.
68—Crane Co., Chicago, Ill.
70—Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
71—Sterling-Cooper Corp., New York, N. Y.
72—Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.
80—Newport News S. & D. D. Co., Newport News, Va.
81-82—Model of S. S. *Leviathan.*
83—Gimbel Bros., New York, N. Y.
84—Todd Shipyards Corp., New York, N. Y.
85—Westinghouse Elec. & Mfg. Co., East Pittsburgh and New York.
86—Marine News, New York, N. Y.
87—Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
88—Todd Shipyards Corp., New York, N. Y.
90—Chase Metal Works, Waterbury, Conn.
96—Marine Decking & Supply Co., Philadelphia, Pa.
99—Lunkenheimer Co., Cincinnati, O.
100—Worthington Pump & Machinery Corp., New York and Harrison, N. J.
101—Kingsbury Machine Works, Philadelphia, Pa.
107—P. S. Thorsen Co., Brooklyn, N. Y.
108—H. E. Boucher Mfg. Co., New York, N. Y.
111—B. F. Sturtevant Co., Hyde Park, Boston, Mass.
221—Masters, Mates & Pilots, New York, N. Y.
222—Ocean Assn. of Engineers, New York, N. Y.
223—Neptune Association, New York, N. Y.
224—American Bureau of Shipping, New York, N. Y.
225-227—Maritime Assn. of the Port of New York, New York, N. Y.
228—New Process Chemical Co., New York, N. Y.
229—American Society of Marine Designers, Quincy, Mass.
230—Check Room.
237-245—U. S. Navy.
246-248—Port of New York Authority.
249-270—U. S. Shipping Board.
273—Pioneer Company, New York, N. Y.
274-275—United American Lines, New York, N. Y.
277-287—U. S. Shipping Board.
288-303—U. S. Navy.
304—Crane Packing Co., Chicago, Ill.
316—Luckenbach Steamship Co., New York, N. Y.
327—Stamford Foundry Co., Stamford, Conn.
344-346—American Marine Assn., Inc., New York, N. Y.
347-349—Society of Naval Architects & Marine Engineers, New York, N. Y.

Inventor of Isherwood System Here

Sir Joseph W. Isherwood, inventor of the Isherwood system of ship construction upon whose patent about 12,000,000 tons of vessels have been constructed, arrived in New York on the *Majestic,* August 23. Sir Joseph will remain in the United States for a month or two as he has some very important business in hand. He will undoubtedly visit a number of the prominent shipyards.

Speaking of the voyage, Sir Joseph said, "just before leaving Southampton it was found that between 30 and 40 of the studs on the rotor of one of the low pressure turbines were broken. A special staff of about half a dozen extra engineers was taken on board in addition to a superintendent and it was decided to make the repairs on the trip.

"Working under conditions of extreme heat this wonderful feat of drilling out and renewing about 40 studs 1½ inches in diameter was accomplished in 30 hours while the steamer proceeded at about 17 knots."

Notes on Dead Freight, Detention and Demurrage

By Robert E. Annin

In this article Mr. Annin explains from a wealth of practical experience a number of the ordinary and extraordinary occurrences that are apt to prevent economy in turnaround. While the possible situations that may occur cover so wide a range that no treatise can be expected to supply a full set of precedents, nevertheless the examples given form a basis which supplemented by experience and common sense ought to be of great value in preventing the losses in ship operation that depend upon the period elapsing between a ship's entering upon and release from service.

THE chief protection against loss to the ship caused by shipper's or charterer's delay in the delivery or removal of cargo lies in the penalties known as dead freight, demurrage and detention damages. Broadly speaking, the first applies primarily to berth shipments, the second to charters and the third to special cases technically falling outside the ordinary provisions of the first two. Since delays cause irrecoverable losses to one or the other party in interest, there are no provisions of a freight contract which are more frequently the subject of acrimonious dispute and in the discussion of which novel technical positions are more frequently assumed.

The enforcement of full demurrage on the ship as a penalty for default in shipment or removal of parcel lots is of course ordinarily impracticable, since in a majority of cases the value of the cargo would be insufficient security for the demurrage claimed.

Further, to hold up an entire shipload for default on a parcel lot would be a damage to all non-defaulting shippers; and, if the ship be not actually delayed, demurrage cannot be earned.

Bill of Lading Requirements

Hence the ordinary bill of lading provisions for dead freight in case of shipper's default in delivery, and for delivery into store at cargo's risk and expense in case of failure promptly to accept and remove on discharge.

This is subject to the obligation of owner or agent to make every effort to reduce shipper's loss by filling the unused capacity in the open market. Nor may the ship take any action at port of discharge which shall cause *unnecessary* loss to the cargo owner.

To meet special conditions, special clauses are, however, often desirable on the bill of lading.

One very striking incident of this sort occurred shortly after the end of the great war. A certain shipper had made berth term engagements for full cargoes of general merchandise from the United States to Europe. No charter was made and the bill of lading contained the usual discharging clause.

Learning that the port of discharge was badly congested, the warehouses full and the wharves crowded with cargo, the carrier decided to protect himself with a special clause, fearing that such congestion, etc., might continue until the arrival of one or more of the ships. Clearly, if no warehouse or dock room, or even river or harbor craft should be available on arrival of the vessels, the carrier's right to discharge into store, etc., would be barren; and (no other recourse being stated in the contract) it might be that the consignees could use the carriers' property as a free warehouse and the latter have no remedy.

A Special Clause

To cover this possibility the following clause was inserted:

"Should consignees fail to remove cargo promptly and should storage room be unavailable, the carrier shall be entitled to damages for resulting detention to steamer, at the per diem rate of ——— U. S. gold per ton of steamer's net register; and the same shall be a lien upon the cargo until paid."

As it turned out, it was most fortunate that this precaution was taken. The port was in chaos on arrival of the ships, some of which were delayed over a month beyond a proper discharging time.

The case, however, differed from ordinary berth term shipments in that the complete cargoes were from one shipper and to one consignee. In the event of several shippers and more consignees any such clause would have been unworkable. Nor would such a provision properly fall under the head of demurrage, but rather of detention damages.

Record of Lay Days Essential

In ocean traffic demurrage is commonly to be considered in relation to voyage charters only, and since demurrage can only begin upon expiry of lay days as provided, an undisputed record of countable lay days is essential for the ship. Hence a proper charter form must clearly provide for the earliest day and hour at which days may begin to count; the exemptions (if any) agreed upon and the conditions which shall constitute a proper tender. The potential importance of an exact count from the beginning to the end of lay days is often overlooked. Let the charterer fulfil his contract by completing the loading before or by the expiration of lay days, and no question of demurrage may be brought against him. But if he delay the ship, if only by a few hours, any cause of delay developing between expiration of lay days and completion of loading, may involve a valid demurrage claim, even though the delay run to days or even weeks.

In such case the test question is apt to be—would the ship have met the delay, if the charterer had loaded her within the time granted in the charter party?

Examples That Might Result in Serious Demurrage

To illustrate,—should a ship whose days expired at noon on a Saturday be incompletely loaded at that hour, and a general dock strike develop on Saturday afternoon, the charterer would ordinarily be bound for all resultant demurrage even though the delay should be far in excess of the time required to load the ship. For the strike clause, like other exemptions of the charter party, can be claimed by charterer only during lay days.

Nor is it always possible for the charterer to accept loss by paying dead freight in lieu of completing the loading. In the case of a bulk cargo sold "10 percent more or less" it might be that the minimum quantity permitted by the contract of sale had not been loaded when the interruption occurred. The charterer would then have to choose between the payment of demurrage up to completion of loading, and jeopardizing his sale by tendering a quantity below the contract limit.

From such instances it is sufficiently obvious that demurrage and detention clauses cannot be considered too carefully, in relation to their potential relation to other charter clauses.

Tendering, Strike and Berthing Clauses

Closely related to this matter are the tendering, strike and berthing clauses. In relation to the two last, questions may

easily be raised in connection with conditions existing at the dock to which ship is ordered by charterer.

For the latter to select a wharf where loading was interrupted by strike, the claim benefit of the strike clause would be obviously unfair if other berths not so affected were available. Such a right if recognized would clearly be subject to grave abuse.

In such case, however, the owner or agent should refuse the berth when tendered. To accept the order to berth without demur might be considered as a waiver on the ship's part.

As a curious instance of the defenses which may be set up against demurrage, may be cited the case of a sailor in a South American port. Charter party obligated charterers to provide stiffening when and as called for by the master, as the ship could not shift or stand up without ballast. The stiffening was not provided in accord with contract terms and vessel was therefore delayed in discharging. Claim for demurrage was refused by charterers on the ground that the ship was not a good tender until discharged; that lay days could not therefore begin, and that no demurrage was due until lay days had run out. This was an ingenious method by which defendants endeavored to make their first default neutralize a subsequent delinquency.

The case was decided by awarding detention damages to the ship based on the rate of demurrage provided in charter.

An interesting detail was that charterer's agent had induced the master to sign a certificate which substantiated the charterer's claim as to days used in loading, but which the facts as established contradicted. The decision therefore supported the principle that a certificate of the master, not in accord with the facts proved or admitted, may be disregarded. But the main point decided was of course that neither party may claim benefit of a default of the other when same is directly due to his own delinquency.

Action to Reduce Losses to a Minimum Necessary

This leads to another point, not to be easily stated in a phrase, but of great influence in case of controversy.

In case of unforeseen and unforeseeable events, not specifically covered by charter provisions, the party observant must act so as to cause the least possible loss or expense to the party delinquent. As an actual incident:—

A ship, discharging at New York, had left in her 300 tons of ore, when a dispute arose resulting in the temporary holding of the ore by the carrier, as security for demurrage. The carrier had two courses.

First, to hold the cargo in the ship, charging against it the full amount of demurrage accruing day by day, or—

Second, to secure lighters and discharge into them; thus releasing the ship, and avoiding full demurrage as provided in the charter party, but making the cargo liable for lighter hire during the time that the dispute might continue. The second course was by far the less expensive, and the ship chose it.

But in the course of arbitration it developed that, had the other course been chosen, the ship could not have enforced a claim for full demurrage; on the ground that in case of default, the party observant is obliged to pursue the course obviously least damaging to the party delinquent, provided the security of the first party were not thereby impaired. In this case the security was the ore. If it could be held in barges at a cost of say $100 per day, it was the duty of the carrier so to dispose of it pending settlement; since the cost of demurrage on the ship itself would have been $750 per day.

Ready and Seaworthy

The question as to what constitutes readiness clearly has a vital effect upon possible damages for delay. Under long standing decisions of English law, it has been decided that readiness to load does not necessarily imply readiness for sea. This is also confirmed by universal practice; for few ships when tendered for loading fully meet requirements of seaworthiness as to provisions, crew and bunkers. As to engines and equipment the case is not so clear. Customarily, if a ship be tendered seaworthy as to hull, and with all holds ready to receive cargo, charterers do not object to minor repairs, not interfering with loading, whether to engines, decks or rigging. But a recent American decision held that a motor-schooner tendered on her cancelling date with engines in dismantled condition, justified charterers in cancelling the charter. Certainly in case it were doubtful whether engines could be made seaworthy by the time loading was complete, objection on the part of the charterers would seem to be justified.

Termination of Lay Days

Another question has been recently raised concerning the termination of lay days. A coal charterer, having delivered a full cargo of coal to a ship, claimed that lay days ceased with the arrival of the last coal in the hold of the ship and that time occupied in trimming was for the account of the owners. There appeared to be no precedent for this nor was the point directly covered in the charter. It had therefore to be argued from the lay day clause as written.

That clause stated: *"Cargo to be loaded at the rate of* 1,000 *tons per day;"* and the meat of the question (when it came to be considered) lay in the proper definition of the term *"loaded."*

When, therefore, is cargo loaded in the sense that the charterer's obligation in relation to lay days terminates? Charterers claimed such point to be reached when cargo was aboard ship; owners claimed that it was reached when cargo was aboard *and stowed.*

Trimming for coal is equivalent to stowage for most cargoes.

Now evidently in the case of general cargo, the "loading" is not complete either when the cargo is placed alongside ship (which constitutes *delivery* under most charters) nor even when it is taken aboard. Such cargo is only *loaded* when it is stowed and secured in the hold and the ship safe to proceed, so far as cargo is concerned. Hence, in general cargo, the term "loaded" means "put aboard and stowed."

Grain Must Be Stowed

In the case of grain, the cargo is delivered by shipper to the elevator, and the loading is by belt carrier or by gravity. The grain has to be trimmed, and a part bagged. The time required for bagging and trimming is always counted as part of the lay days in loading grain, and on the face of it, properly so. It would be a gross injustice to the ship merely to dump the grain in the holds, and claim that loading was complete. Therefore, in grain cargoes the term "loaded" means "on board and stowed." The same argument may be used in regard to lumber and other cargoes.

"But," said the charterers, "the trimming of coal is by contract paid for by the ship; and if the duty, responsibility and expense belong to the owner, the time also must be for owner's account. Also, suppose the coal lay untrimmed for a week; would that week count on lay days?"

The first of these points is covered by the analogy of general cargo, grain, and lumber. In all these articles, the cost of stowage is borne by the ship under ordinary gross form charters, but time spent in stowage counts on lay days.

The second point is only well taken in case the ship neglects, or for any reason does not use, due diligence in the trimming.

The conclusion finally reached may be summed up in the following: "and properly stowed; but the ship must use due diligence to complete stowage as promptly as possible during working hours. Any unnecessary delay in stowage or trim-

ming the cargo shall not count as lay days, or in demurrage, as against the charterers."

Delays Caused by Strikes

The so-called "Strike Clause" is likely to cause as much controversy as any other ordinary provision of a charter party. Stoppage of labor on wharves or lighters directly involved is simple enough. The term "extraordinary occurrence," which is often used, is not very conclusive; yet it is difficult to see how it can be expanded with any real advantage. What is an extraordinary occurrence? Let us say an occurrence which ordinary foresight and diligence could by no means have prevented or provided against. The Martinique volcano; the Galveston cyclone; the Great War; clearly would come under this definition; as might a disastrous fire or earthquake in New York, Norfolk, or San Francisco.

But these are all obviously extraordinary and would probably be covered by the "Act of God" etc. clause. The puzzling questions are those which come up when an occurrence is close to the line of ordinary or extraordinary; a gale in harbor; a fire or strike of limited extent but wide influence; a sudden change in law; or any other happening which one party may claim as coming within the limits of the ordinary, while the other asserts that it is in the class of the extraordinary. There seems no course here except to leave the definition open until the emergency forces a decision.

Direct Effect of Extraordinary Occurrences

This can be somewhat modified by the stipulation that such "extraordinary" occurrences must "directly" prevent the delivery, loading, or discharge, of cargo; and the effect of the word "directly" should not be overlooked. It is conceivable that a local coal strike might prevent the production of steel in certain mills; an automobile manufacturer being unable to obtain promptly steel contracted for with such mills, might be delayed in shipping an export order; and, further, transportation might be delayed by lack of coal. The result might be that a large percentage of a given cargo would be late in delivery and a ship therefore held beyond her lay days.

Clearly it would not be fair to the carrier to saddle the loss from such delay upon him.

Cases Where Charterer Is Responsible

Again, a local strike might prevent the delivery of the special lot of coal cargo contracted for, by the date which the steamer had been chartered to fit. Here might arise a question, provided other coal of suitable quality were not available. But if such coal were obtainable *at any price* it would appear that the charterer must be held responsible. Otherwise the owner in accepting charter terms would be assuming the guarantee of contract between the charterer and supplier in which he had no interest, and of the terms of which he was ignorant.

In the list of extraordinary occurrences which might raise debatable questions, the following will be pertinent. A shipper had engaged on berth terms, thirty loads of grain for shipment by three successive freight liners. All the grain was coming down by Erie Canal from Buffalo, and ample time had been allowed for the boats to reach New York. But one week before the first lots were due to arrive, a flood caused a break in the canal, holding up the entire shipment for over ten days, and there was no available grain of similar quality in New York.

No such clause as we are now considering was included in the freight engagement, and the carrier therefore had the shipper at his mercy. The matter was amicably and equitably arranged, owing to the liberality and large mindedness of the carrier. But it is no bad guess that, under full charter terms, many owners would have exacted their pound of flesh, unless checked by some such provision as we are now considering.

Experience Best Guard Against the Unexpected

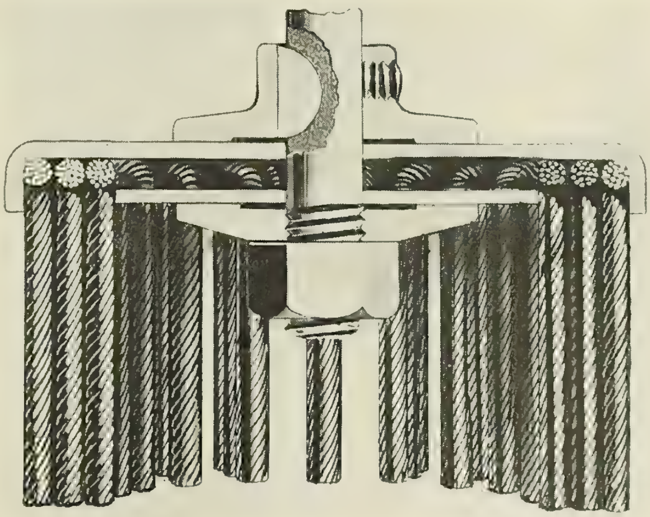
These are merely examples; and current charter forms are full of such clauses gleaned from experience. Hence it is the duty of the charterer to protect himself, by careful study of current practice, supplemented by any special experience of his own, against the unexpected and the unpredictable. Here is the great advantage of the owner or charterer experienced in certain trades. He will know of risks to be run, of contingencies to be provided against, and tricks to be dodged, which the novice (absolute or comparative) cannot possibly foresee.

Another principle which should be borne in mind is that in the absence of special covenant to the contrary, lay days always begin to count with the beginning of loading or discharging, notwithstanding any *general* provisions of charter party.

For these matters, which are of the very essence of the business, experience, aided by common sense, is the only true teacher. The possible situations have so wide a range that no records of the past can be expected to supply a full set of precedents. The vital importance of a correct estimate of the time required for a given service, is obvious in relation to arrangements of deferred business. Further, profit or loss on any gvien voyage depend largely upon the length of the period elapsing between the ship's entering upon and release from the service, since the ship's expense is in proportion to the time used. In the case of chartered ships this factor varies in importance according to the proportion of expense which the contract between the two parties imposes upon the shipowner.

Wire Brush Attachment for Air Grinders

In ship work where the removal of rust and old paint forms a very essential operation in the repair and maintenance of practically every vessel, the new wire brush attachment for air grinders produced by the Chicago Pneumatic Tool



Wire Brush for Attachment to "Little Giant" Air Grinders

Company, Chicago, Ill., will be found especially useful. This brush consists of three units, a 1/8-inch back plate, dished as shown in the illustration; a 1/8-inch front plate with a series of slots, and a wire brush consisting of 30 renewable units made of heat-treated crucible steel.

Recent Developments in Marine Insurance

River Plate Controversy—Cargo Clause Changed Protecting the Mortgagee—Carrier's Liability to Shipper—Standard Policy

By "Bordereaux"

ONE of the outstanding features of the past month in marine insurance has been the lively controversy that has developed with respect to the River Plate clauses. There is evidence of a concerted movement on the part of the banks to force underwriters to modify these endorsements and concede coverage on goods held in the custom house awaiting assessment of duties. The clause to which so much objection is being raised reads as follows:

Including (subject to the terms of the policy) all risks covered by this policy from shippers' or manufacturers' warehouses until on board the vessel, during transshipment, if any, and from the vessel while on quays, wharves, or in sheds during the ordinary course of transit or until safely deposited in consignees' or other warehouse at destination named in policy, except that in respect to shipments to the River Plate, the risks under this insurance shall cease upon arrival at any shed (transit or otherwise), store, custom house or warehouse, or upon the expiry of ten (10) days subsequent to landing, whichever may first occur.

The reason this discrimination had to be made against shipments to the River Plate lies in the fact that fires so continually broke out at the point involving the underwriters in a disproportionate number of claims.

The position taken in the revolt of the banks is as follows: The customs regulations of Buenos Aires require that all shipments arriving in vessels from abroad shall be declared within eight days of the entry of the vessel or pay a fine of 2 percent on the customs valuations. Due to the foregoing, the merchants of that market have grown to consider this interval as a period of grace, during which time they may accept or pay the relative drafts, and many of them invariably take the full eight days. At the same time, the banks which have received the bills for collection have also been in the habit of allowing these eight days to pass before making declaration and insuring the merchandise pertaining to items not attended to. They have been led to do this from the fact that formerly the insurance policies covered the goods for more or less time after unloading and placing in the Government warehouse, usually for a period longer than eight days, but when a special qualifying clause was added to the policies because of disastrous fires which took place in deposits their custom was not altered.

Cargo is not unfrequently landed and stored in a Government warehouse for several days before expiration of the above-mentioned period, and whenever this happens the goods remain unprotected until covered by fire insurance. For the banks to cover all shipments, the documents for which pass through their hands, on the day of entry of the vessel and attempt to collect the proportionate premium from the drawee of the respective bills would probably result in much trouble and argument for them, to say nothing of losses from delays in payment or acceptance of drafts. This attitude of the Buenos Aires banks is being brought to the attention of their correspondents in this country to the end that something may be done to cover this phase of insurance; for instance, that insurance policies may be adjusted to cover at least ten days in the customs deposits there, or that instructions may be given by the insurance companies to cover goods for account from the day of the entry of the vessel.

The underwriters, on the other hand, argue that it is not unusual for goods to be held in customs at the River Plate for thirty and forty days, and that such extended risks were not contemplated by them in their rate of premium; nor do they care to encourage such unnecessary and dilatory practice by granting coverage at a higher rate, although in most cases the shipper can arrange at the time of placing his insurance for a cover of thirty days after discharge from the steamer.

There would seem to be considerable merit in the contention of the banks that the clause of the underwriters should be so worded as to grant, say, not exceeding ten days coverage in the custom house and/or on the wharf instead of making the insurance terminate as at present. Under the regular warehouse-to-warehouse clause the risk in customs is covered during any period of ordinary transit. Indeed, unless some concession is made by the underwriters, it is evident that they stand a good chance of having this business lost to the American market, as the consignee is very likely to arrange for insurance in Argentina under his open policy. A marked tendency in this very direction has been observed of late in both Argentina and Australia.

New Cargo Clause Changed

WITH the evident intention of preventing ship owners and operators from evading any part of their legal liability Clause No. 9, of the new American Institute Cargo Form 1922, has been amended with the approval of underwriters to read as follows:

"Warranted that this insurance shall not inure, directly or indirectly, to the benefit of any carrier or bailee; and warranted also that the assured has not made and will not make any waiver or special arrangement with any carrier or bailee who shall have the custody of any goods hereby insured, releasing such carrier or bailee from its or his common law or statutory liability."

Protecting the Mortgagee

AMERICAN marine underwriters have concluded that they will in the future be obliged to scrutinize their hull coverages very carefully to make sure that their own interests are protected quite as much as those of the mortgagee, especially if the appellate courts of Great Britain sustain the recent decision of Justice Greer in the case of the steamer *Ioanna*. This vessel was of Greek registry and was sunk in the Mediterranean during the epidemic of Greek total losses. In the course of subsequent litigation it was established that the vessel had been deliberately cast away and not lost through a war peril, as alleged by the owners. The underwriters on the war risk were excused from liability, but the Justice held that they were liable under marine risks for an amount equal to the mortgage on the vessel. It was held by the court that the mortgagees were not responsible for the loss, as they had not connived with the operators. To protect them, the Justice ruled that the boat was lost by the entrance of water into the hold, and that is a marine peril. Marine underwriters insist, however, that the business of insurance ought not to be saddled with fraudulent losses for the sake of mortgagees who are not parties to the insurance contract. Unless the sinking of a vessel is an act of barratry, the risk, they insist, is not covered by the marine policy.

In this case of the *Ioanna,* as well as that of the *Gregorios,* a similar Greek loss, the case of Small vs. the United Kingdom Company was cited as a precedent, and apparently had considerable weight with the court. In this celebrated case the vessel was deliberately cast away. The offending master was part owner, but the other owner was innocent. Suit was brought by the innocent owner and he won his case on the contention that the co-owner had committed a barratrous act. Underwriters regard this as a bad precedent to have followed in the cases above referred to. That there is a wide variance of circumstances, the following summary by Gow, in his "Sea Insurance," proves: "Interests of mortgagor and mortgagee are distinct; master who is mortgagor can commit barratry against mortgagee, provided he was not appointed by mortgagee; policy effected by mortgagor; intention to benefit mortgagee."

Dry Dock on a Rampage

DRY dock underwriters had a narrow escape from a serious loss recently when the main dry dock of the Jahncke Dry Dock and Ship Repair Company, of New Orleans, broke loose from its moorings with the steamer *Nyanza,* of the Pacific Caribbean Gulf service, in dock. Scarcely had this steamer been admitted to the dock when the latter tore away from the wharf and started on a wild rampage down the river. It made an impromptu voyage of two miles before being captured by tugs. Fortunately, the *Nyanza* had been able to slip out without damage. It was astonishing that none of the shipping in the harbor was rammed by the dock; several vessels were missed by inches.

Liability of Carrier to Shipper

IN an interesting case recently decided by the United States Circuit Court of Appeals, Second Circuit (279 Fed. Rep. 684), several involved questions arose as to who was the insured and who the insurer. The Virginia-Carolina Chemical Company brought suit against the Chesapeake Lighterage and Towing Company for the recovery of damages alleged to have been sustained in the total loss of certain merchandise of the former carried on a barge of the latter, which sank in the course of its voyage. It was alleged that when the lighterage contract was made, it was agreed that the Chesapeake company should insure all goods while on its lighters up to the sum of $6,000, "provided there was no prior insurance." As a matter of fact the Federal Insurance Company had a policy in force covering the company which sold the goods to the libelant, "on account of whom it may concern," and it concerned the libelant apparently as holder of bills of lading for the merchandise under consideration at the time it was put aboard the barge.

This insurance covered the goods from time of shipment until delivery at destination, and specifically included "all risks of lighterage;" but such general assumption was limited by the following exceptive provision:

"Warranted by the assured free from any liability for merchandise in the possession of any carrier or other bailee, who may be liable for any loss or damage thereto, and for merchandise shipped under a bill of lading containing a stipulation that the carrier may have the benefit of any insurance granted thereon, and that any insurance granted herein shall not cover where any carrier or other bailee has insurance (whether prior or subsequent in date to this policy) which would attach if this policy had not been issued."

At the time when the Chesapeake company agreed to carry the merchandise in question it had a policy in the Fireman's Fund which by its terms covered "merchandise and property on which the insured have agreed with the shippers to provide insurance, also their legal liability in cases where they have not agreed to provide insurance." And this policy, again, carried the following: "Warranted by the assured that any insurance granted herein shall not cover where the assured or any carrier or other bailee has insurance which would attach if this policy had not been issued."

When the goods at question were lost, the libelant received from the Federal Insurance Company what would have been its loss under that company's policy, but only "as a loan, and repayable only to the extent of any net recovery it may make from any carrier, bailee or others on said merchandise." The receipt for this loan contained the usual agreement on the part of the libelant to prosecute suits as required by the Federal; hence the suit against the Chesapeake company, the contention being that the policy with the Fireman's Fund made the latter liable to the libelant.

The finding of the trial court was for the libelant as against the Fireman's Fund only, but dismissed the libel as against the Chesapeake company. Whereupon the Fireman's Fund appealed. The Circuit Court of Appeals reversed the decree of the lower court, without costs, and remanded the cause, with directions to dismiss the libel, without costs. The court held that the cargo owner could not recover on such a policy for loss of cargo as "the assured," where it had other insurance, nor through liability of the ship owner where the latter was not charged with any fault—as was the case in this instance.

Standard Marine Policy Needed

CONSENSUS of opinion is slowly crystallizing around the idea of devising a standard marine insurance policy to cover all nations. It has many supporters in America, and is being actively urged in various parts of the United Kingdom. Not long ago a Liverpool newspaper approached a number of prominent marine underwriters for an expression of opinion on the plan, and they declared that among other advantages that would follow a universal adoption of such a proposition would be the doing away with a great amount of expensive and unnecessary litigation. This would especially be true were such a policy made to apply to hulls as well as cargo. One of the difficulties appears to be as to the form of policy. It has been suggested that the only way to arrive at a satisfactory result is to have a general policy for all kinds of cargoes and all kinds of hulls for all countries of the world. Two separate policies, one for hulls and one for cargoes, would entail dissatisfaction. Says one authority: "The modifications which would be absolutely necessary to suit different classes of vessels, different forms of goods, and the many different ideas of shippers as to how much they are willing to pay for the kind of insurance they want, would lead to chaos, and in all probability involve just as much litigation as the present system." The suggestion now is to have a round-table discussion between representatives of the principal countries.

Warehouse to Warehouse

SVEND ANDERSEN, general manager of a prominent Danish insurance company, has some interesting views on the joint warehouse to warehouse clause, and he expressed them frankly in an address he delivered before the recent Second Northern Marine Insurance Congress, held at Copenhagen. His conclusions, summarized, are as follows:

1. The clause must not act as a new extension of the risk, only as an extension of the ordinary conditions of the policy.

2. Fundamentally, the clause is only valid for the ordinary course of transit.

3. The underwriter should see that his risk is limited to a certain number of days after the unloading of the goods, irrespective of whether the goods within that period reach the warehouse.

4. The underwriter should never undertake to insure the

goods after the arrival at the consignee's warehouse, and should claim all losses notified immediately at the expiration of the risk.

5. The underwriter should, in a reasonable measure, give the insured an opportunity of being covered under deviations, against an additional premium. The insured must, however, get to know that marine insurance in essence is *uberrimæ fidei.*

6. The underwriter should use a "proof" clause for composite transports to ensure that he is not to pay for losses sustained under the preceding part of the transport, when he was not on the risk.

7. The underwriter must understand clearly that the warehouse to warehouse clause is a considerable extension of the risk, and consequently claims a big increase in the premium.

New Rivet Gun Speeds Up Rivet Passing

THE need for speed and safety in passing rivets in the shipyard led to the development by the Pennsylvania Flexible Metallic Tubing Company, Philadelphia, Pa., of a machine known as the Penflex rivet gun which is intended to deliver hot rivets from the forge to any part of the ship through a special flexible tubing. The gun comprises four heavily built parts—a compressed air tank, a head mounted on the tank into which the hot rivets are dropped, a metal delivery tubing and a receiver at the end of this tubing. The completely assembled device is shown in the illustration.

In use the gun and forge are located at the most convenient point for operation, and the tubing is led to the place where the rivets are to be driven. As each rivet is heated and ready to be passed it is set by the heater on a valve provided in an opening contained in the head of the gun. By its own weight the rivet opens this valve and enters the machine. Automatically the valve recloses and the rivet is sent through the tubing by the depression of a foot treadle. This latter operation releases the compressed air, which has been supplied to the tank, into the head of the machine and the impulse shoots the hot rivet through the tube to the receiver at the other end.

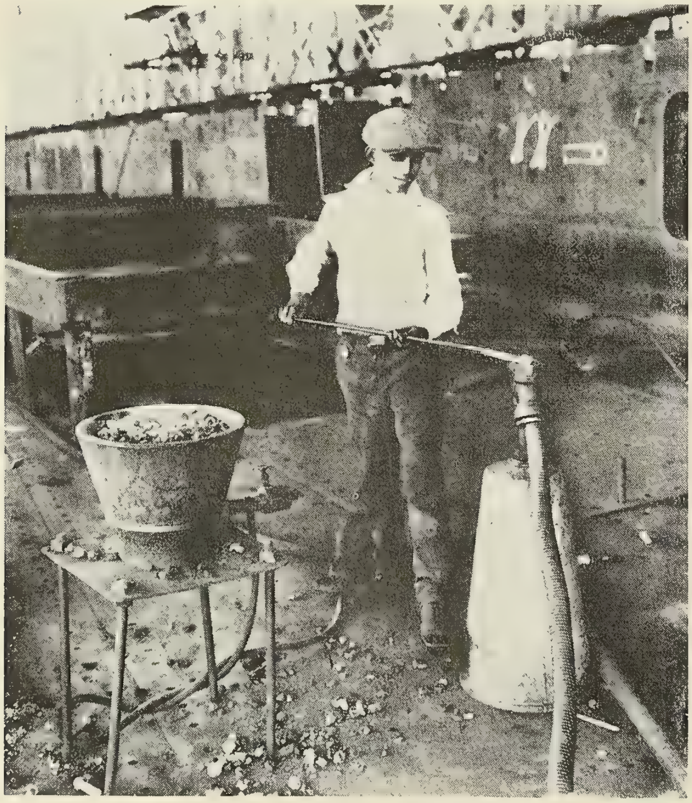


Fig. 1.—Heater Boy at New York Shipbuilding Corporation Yard Dropping Hot Rivet in Head of Penflex Rivet Gun for Delivery By Compressed Air Through Metal Tubing to Riveting Gang

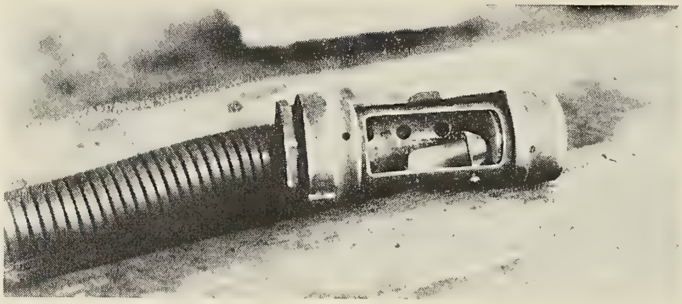


Fig. 2.—End of Metal Tubing Where Hot Rivet Is Delivered to Riveter

The standard gun has a distance capacity of 125 feet and it is stated that rivets can be delivered up or down at the rate of nearly 20 feet a second.

Corrugations are arranged in the tubing which act as a tumbling barrel and remove all hard oxide scale from the rivet so that the rivets are delivered hot free from scale.

Lehigh Car Float Launched at Baltimore

THE first of three car floats under construction at the Baltimore Dry Docks Plant, Baltimore, Md., of the Bethlehem Shipbuilding Corporation, Ltd., for the Lehigh Valley Railroad Company was launched on July 22. The float launched is the largest of the three, its principal dimensions being as follows:

Length, molded	325 feet
Breadth, molded	38 feet
Depth, molded at side	10 feet 6 inches

This float contains three tracks and has a capacity for carrying twenty loaded freight cars. It was towed from Baltimore to New York for delivery and will be used by the Lehigh Valley Railroad for conveying cars to various points in New York Harbor.

Of the two remaining floats one is 270 feet in length, 38 feet in breadth and 10 feet 6 inches in depth, while the other is 180 feet in length, 36 feet in breadth and 9 feet 6 inches in depth. All of these floats are of steel construction throughout with the exception of the deck houses which are of wood. The smallest, which is to be used in carrying refrigerator cars, has a covered platform in the center with a track on each side.

Operations of Shipping Board Vessels.—Chairman Lasker of the United States Shipping Board has recently made public the results from the operation of vessels for the month of June. The total expenses incurred in excess of income from vessel operations (including overhead, repairs, insurance and lay-up expenses) were $2,783,216.29. This result is almost as good as the result attained in May, which was the most favorable month under the present board in the operation of Shipping Board vessels. The corresponding excess of expenses over income for the month of May was $2,660,486.81, or a slight increase in the month of June of $122,729.48. The net excess of outlay over income on voyage operations for May (excluding overhead, repairs and insurance) was $376,445.84. In June, for the first time, income exceeded outlay, the excess of income over outlay amounting to $204,531.75. This improvement is due partly to the increase in passenger revenues, which for the month of June showed an excess of income over outlay (excluding overhead, repairs and insurance) of $354,630.78.

Cargo Steamer Steel Traveler, of 10,050 Tons D.W.

Designed Particularly for the Handling of Long Length Cargoes Such as Steel Rails and Structural Shapes or Lumber

THE only large ocean going steel cargo vessel designed for the carriage of general cargo, now under construction in American shipyards, is the *Steel Traveler* which will be launched at the yard of the Federal Shipbuilding Company, Kearny, N. J., about September 1. The surplus of general cargo vessels owned by the Shipping Board and now tied up in various waterways has prevented any new building except where special or very efficient types were required.

Of the other vessels designed for special freight trades now under construction, the largest are the coal and ore and the oil and ore ships of 13,500 gross tons which are being built by the Bethlehem Shipbuilding Company. Freighters for service on the Great Lakes ranging from 4,900 to 8,500 gross tons are also building at the plants of the American Shipbuilding Company, the Great Lakes Engineering Company, the Manitowoc Shipbuilding Company and the Toledo Shipbuilding Company. In addition to the above mentioned cargo ships the Bethlehem Shipbuilding Company has started work on two small freighters for the coastwise trade of the Eastern Steamship Company.

The *Steel Traveler,* although similar in design to the ten 9,600-ton deadweight freighters that have been built at the Federal Shipbuilding Company during the last three years, namely: the *Steel Worker, Steel Mariner, Steel Trader,* etc., has, nevertheless, several features incorporated in her design which will increase her efficiency over the previous vessels.

10,050-Tons Deadweight Capacity

The principal improvement is the elimination of the well aft which was made by a continuation of the bridge deck to cover the space. In this way the permissible load draft has been increased from 25 feet 10¼ inches to 27 feet and the deadweight carrying capacity from 9,380 tons to about 10,000 tons.

The vessel is a steel single screw steamship of the shelter deck type having a straight stem and an elliptical stern and it is being constructed to the highest rating of the American Bureau of Shipping, +A.1 (E). The transverse system of framing is used and there are seven watertight bulkheads, including the collision bulkhead which extends to the shelter deck and after peak bulkhead, which extends to the upper deck. There is also a longitudinal bulkhead extending from frame 104 to frame 115 dividing cargo hold No. 3 so that it may be used as a hold or ballast tank.

Accommodations

Under the steel pilot house, which contains the wheel room, chart room, wireless and battery rooms, are the captain's quarters. They consist of a stateroom, office, day room and bath which are also inclosed in a steel structure on the bridge deck. A little forward of amidships on the shelter deck are the deck officers' accommodations, including the owner's stateroom and bath. The dining saloon is located in the forward central portion of this structure with the pantry, pantry stores, dispensary stores and linen locker.

The galley is located on the same deck aft of the engine hatch in a compartment formed by a continuation of the engine casing. There are two steel houses abreast of the engine and boiler casings. The engineers are quartered in the starboard house and the petty officers in the port house. Oilers, firemen and crew are berthed in staterooms on the upper deck aft, where their mess and wash rooms are also located. The hospital, carpenter shop, store, lamp and paint rooms are situated forward on the upper deck.

Joiner Work

The pilot house and captain's quarters are sheathed with tongued and grooved cypress. Hard wood flooring is laid in the captain's rooms. The houses on the shelter deck are finished in tongued and grooved cypress with the exception of the dining saloon which is paneled in oak with white paneling overhead. The crew's quarters are also finished in tongued and grooved cypress with overhead ceiling of the same.

Brass beds are furnished for the captain, owner and chief engineer. Built-in wood berths with drawers below are fitted for the rest of the officers and wardrobes are provided in each room. The outside wood doors in the deck houses are of cypress, solid framed with solid flush panels 2½ inches in thickness.

Flooring

All rooms and passages in the officers' quarters on the shelter deck, with the exception of bathrooms, are floored with Litosilo decking 1½ inches thick. The hospital and the living and mess rooms in the crew's quarters are also floored with this material. Vitrified tiling of hexagonal shape is laid in the officers' and hospital bathroom. Linoleum ⅛-inch thick is laid in the wheel house, chart room and wireless room. Brick is used on the galley floor and both brick and tiling are laid in cement 1½ inches in thickness.

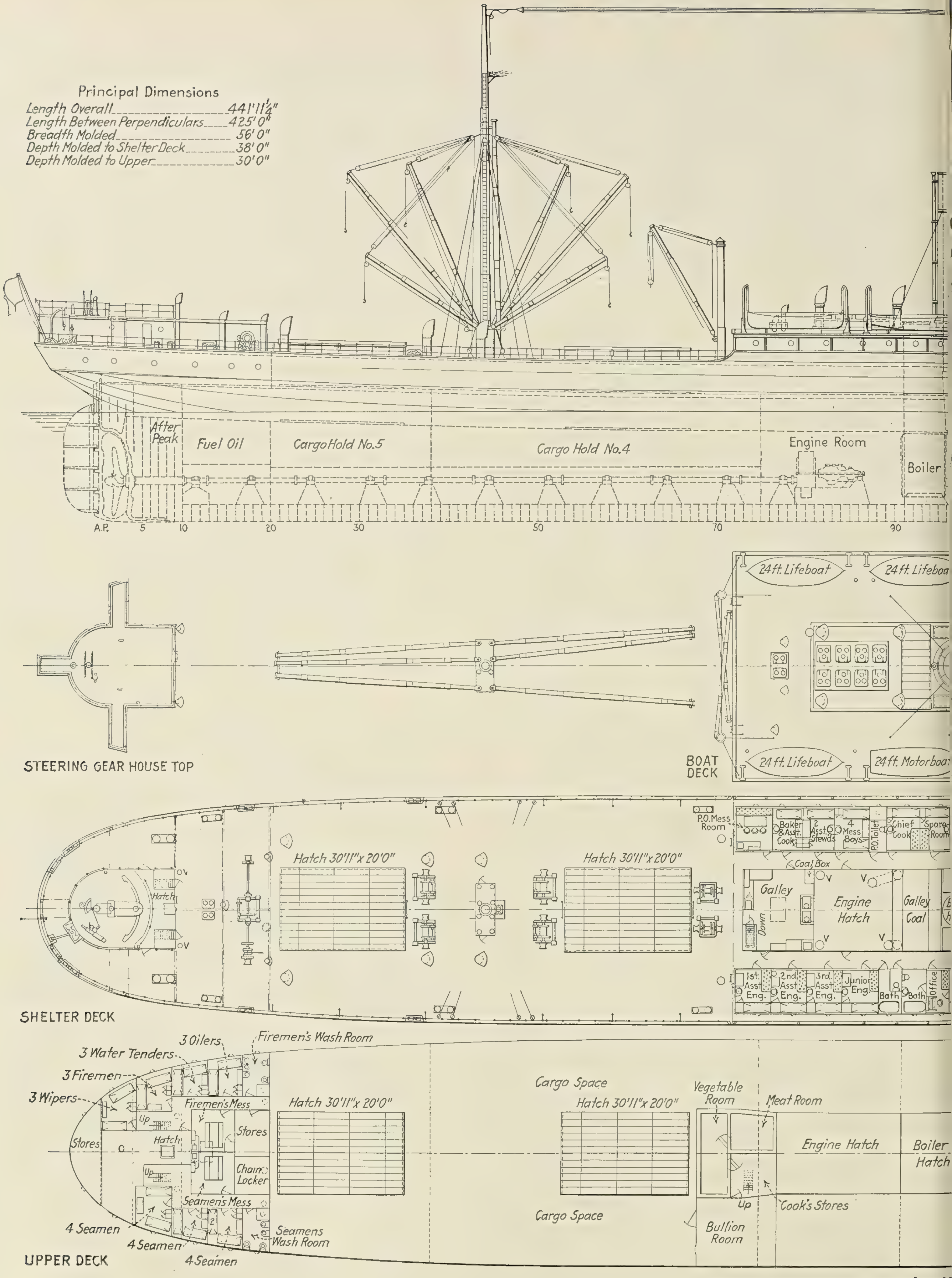
Cargo Handling

Cargo will be handled by 24 booms of long length for the particular cargo which this vessel has been designed to carry, 8 of which are 5-ton, 12 are 8-ton and 2 are 30-ton capacity. These booms are attached to 2 steel pole masts of long length and 8 tubular derrick posts. The steel derrick posts are also arranged to act as ventilators to the 'tween deck spaces and spaces below them. The five hatches are served by 8 single and 9 double geared winches so arranged that one man can handle two winches and watch his lift in the cargo holds.

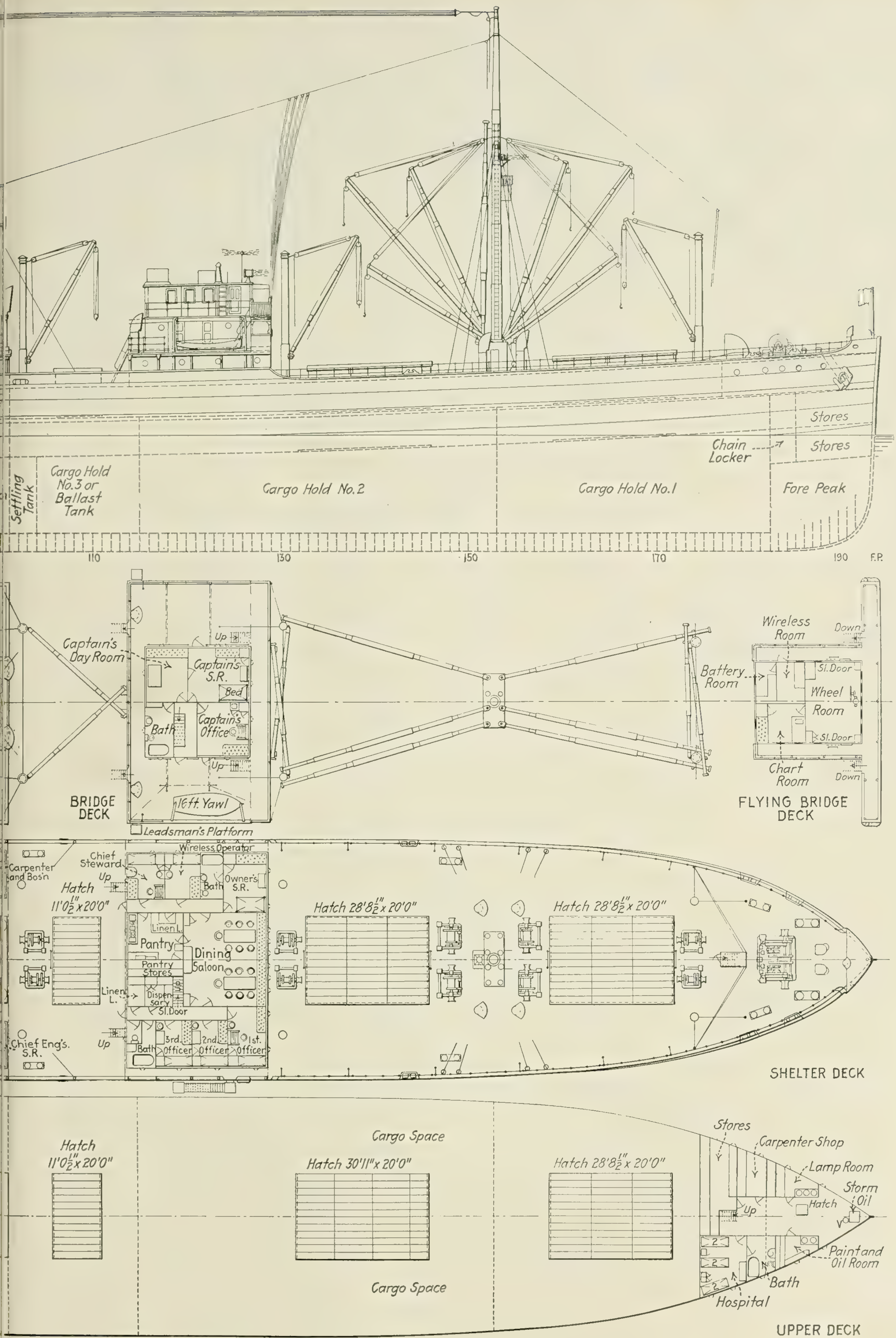
Refrigerating Plant

The refrigerating machine is of the ammonia type having a capacity of 2 tons per day. The plant is required to keep the meat room at a temperature of 24 degrees and the vegetable room at 34 degrees Fahrenheit. The cold storage rooms are on the upper deck and are formed by a continuation of the engine casing. Inside the casing forming the outer walls comes a 3-inch air space, then one thickness of ⅞-inch tongued and grooved spruce, then two thicknesses of P. and B. paper, then two thicknesses of 2-inch cork, then two thicknesses of P. and B. paper, then one thickness of ⅞-inch tongued and grooved spruce, then two thicknesses of P. and B. paper, then one thickness of ⅞-inch tongued and grooved spruce, making a total of about 10 inches.

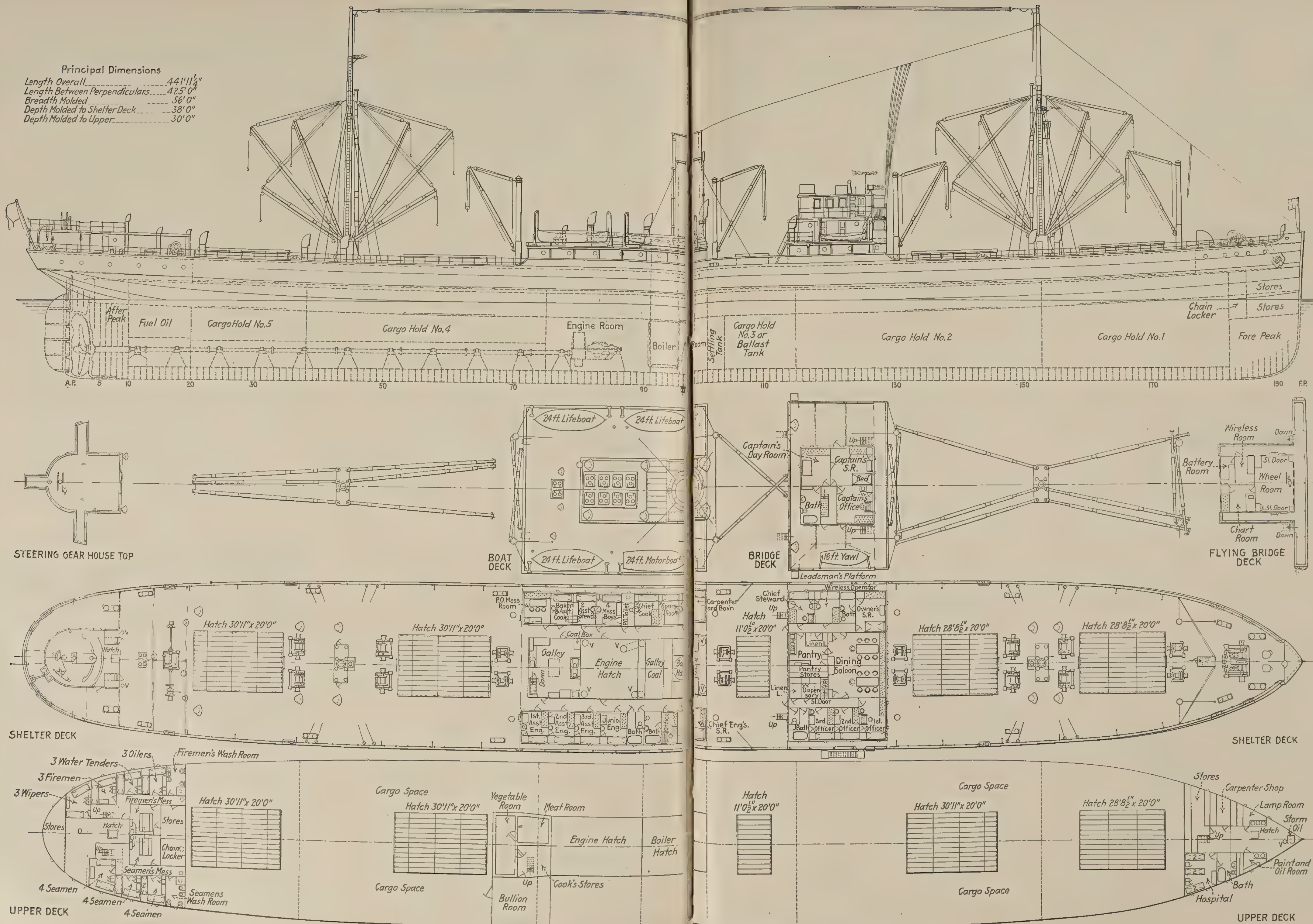
The divisional walls have first, one thickness of ⅞-inch tongued and grooved spruce, then two thicknesses of P. and B. paper, then one thickness of 2-inch cork, then one 1-inch air space, then one thickness of 2-inch cork, then two thicknesses of P. and B. paper, then one thickness of ⅞-inch tongued and grooved spruce, making a total thickness of about 7 inches.



General Arrangement Plans of 10,05



ı Cargo Steamer Steel Traveler



General Arrangement Plans of 10,050 Ton Cargo Steamer Steel Traveler

Cargo Steamer Steel Traveler, of 10,050 Tons D.W.

General Information

Service: .. Ocean Freight.
Builder: .. Federal Shipbuilding Company, Kearny, N. J.
Owner: ... Isthmian Steamship Lines, New York.

Characteristics

Length, overall ....442′-0″
Length, B. P. ....425′-0″
Breadth, molded ....56′-0″
Depth, molded to bridge dk...........38′-0″
Draft, loaded ....27′-0″
Draft, light ....
Block coefficient ....
Midship section coefficient ....
Longitudinal coefficient ....
Speed, loaded, knots 11.5
Cruising radius, nautical miles............
Framing ....Transverse
Class ....+ A-1(E)

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull ....
**Weight Propelling Machinery...............
Deadweight Capacity................ 10,050
Displacement ....

(In tons of 100 cubic feet)

Gross register ....about 7,200
Net register ....about 4,400

* Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.

** Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

Anchors: 2 Stockless ......8,855 lbs. each
1 Stockless 7,525
1 Stockless 3,185
1 Stockless 1,320
Chain: 300 fath. ....2⅜″ stud link
90 fath. ....1 5/16″ stud link

Rudder

Area ....167.50 sq. ft.
Dia. Stock ....12″
C. Press. abaft C. L. pintles............4.14′

Complement

Deck officers 4
Deck crew 16
Engineer officers 5
Engineer crew 12
Purser's and steward's department.......10
Total officers and crew................47
First-class passengers.....................
Second-class passengers....................
Third-class passengers.....................
Total passengers.........................
Total complement.........................

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	Pole	..	86′
Derrick posts	8	Pipe	5 Ton	38′-6″
Booms	24	Steel		

Discharging Capacity...... 8- 5 Ton-30′; 12- 8 Ton-50′; 2-30 Ton-55′

Deck Machinery

(Number, Size, Type)

Steering Gear........Hyde 9x12 steam tiller
Windlass. Hyde No. 11—10″x14″ spur geared
Capstans ....
Winches...........8—8¼x10 single geared
9—8¼x10 double geared

Life Saving Equipment

Lifeboats	No.	Type	Length
30 person	1	Motor	24′
30 person	3	Metallic	24′
Work boat	1	Wood	16′

Propelling Machinery

Boilers

Number 3
Type .........................S.E. Scotch.
Length ....11′-3¾″
Diameter ....15′-3″
Furnaces ....3 each
Fuel ....Oil
Draft ....Forced
Total heating surface, square feet......7,836
Total grate surface or furnace volume ....
Superheat, degrees F....................50°
Working pressure, lbs. sq. in............210

Normal fuel consumption:
Per day, tons 35.9
Per horsepower hour, pounds..........1.08

Normal steam production:
Per hour per pound of fuel...........lbs.
Total per hour................45,375 lbs.

Todd Mechanical Oil Burners

Engines

Number 1
Type....Parson's Cross Compound Turbines
Size............With double reduction gear
Horsepower ....3,100 S. H. P.

Propellers

Number 1
Type ....4 bladed, solid
Weight ....
Diameter ....17′-0″
Pitch ....14′-6½″
R. P. M. 90
Projected area ....
Developed area ....

Auxiliary Machinery

(Number, Size, Type)

Machinery Space

Condensers, cylindrical surface 4,500 sq. ft. ....28″ vacuum
Evaporators....1 Reilly No. 12—25 ton/day
Distiller.....1 Reilly No. 4—2,000 gal./day
Filter and feed tank................720 gal.
Feed water heater..........1 Reilly No. 20
Fuel oil heaters..................2 White

Pumps:

No.	Pump	Size
2	Main & Aux. Fd., V. S.	10x7x24
1	Aux. Air & Circ., H. S.	10x12x12x12
1	Fire & Bilge, H. D.	12x8½x12
1	Ballast, H. D.	10x10x12
1	Sanitary, H. D.	7½x5x6
1	Fresh Water, H. D.	6x4x6
1	Evap. Feed, H. D.	4½x2¾x4
2	Fuel Oil Ser., H. D.	5¼x3½x5
1	Fuel Oil Trans., H. D.	7½x6x10
1	Ice Water, H. D.	2x1¼x2¾
1	Eng. Rm. Bilge, H. D.	6x5¾x6
2	Lub. Oil, V. D.	7½x7x10
1	Lub. Oil Cooler, H. D.	7½x8½x10

Refrigerating Machinery

1 2 ton Brunswick Ammonia

Electric Equipment

Generators...2 Eng. Dr. 10 Kw. 110 V.D.C.
Radio ....2 Kw.
Emergency ....

Holds

No.	Length	Hatches
1	64′	20′- 8½″x20′-0″
2	84′	28′- 8½″x20′-0″
3	31′	11′- 0½″x20′-0″
4	82′	30′-11 ″x20′-0′
5	40′	30′-11 ″x20′-0″

Capacities

Cargo Space

Compartment

Holds, Grain ....262,850 cu. ft.
Holds, Bale ....247,393 cu. ft.
Tween decks, main to upper, Grain ....135,672 cu. ft.
Tween decks, main to upper, Bale ....126,768 cu. ft.
Tween decks, upper to bridge, Grain ....122,165 cu. ft.
Tween decks, upper to bridge, Bale ....114,835 cu. ft.

Refrigerated Space

Compartment	Cu. Ft.
Vegetable	896
Meat	664

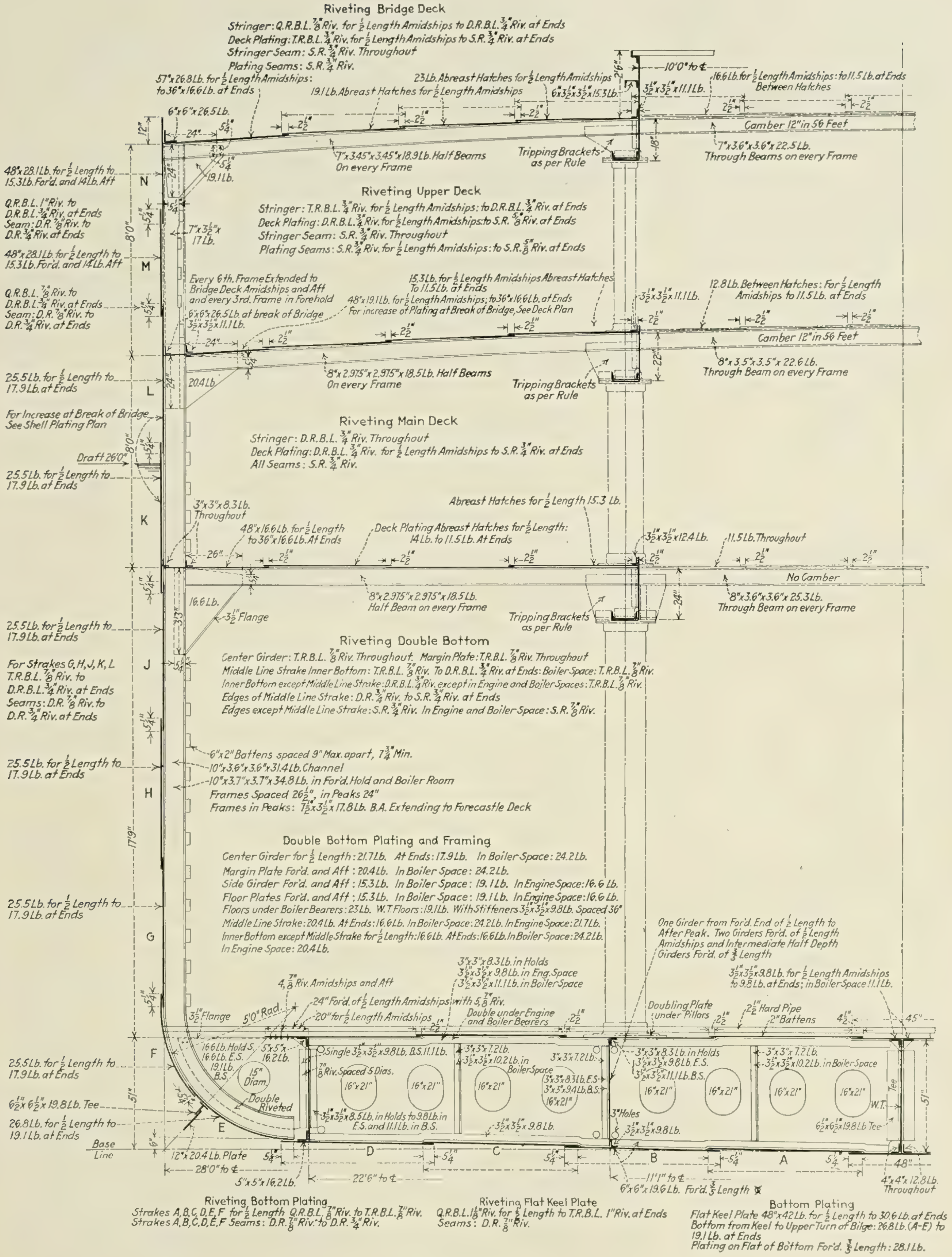
Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons
			2,170

*....cu. ft. per ton;................gals, per bbl.

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Water			1,663 tons
Oil			1,479 tons
Total			



Midship Section

Ventilation

There is one 12-inch ventilator fitted to the store room over the forepeak. Each hold and the corresponding 'tween deck space are served with four ventilators, which are either of cowl type, 24 inches in diameter, or tubular derrick posts fitted with mushroom tops. Two 36-inch ventilators fitted with cowls are installed at the forward end of the boiler room. These ventilators may be operated from the upper platform. The engine room is served with four 24-inch ventilators, two forward and two aft, which can be worked from the upper grating. One 15-inch ventilator with cowl is fitted at the tunnel escape trunk to ventilate the shaft alley.

Boilers

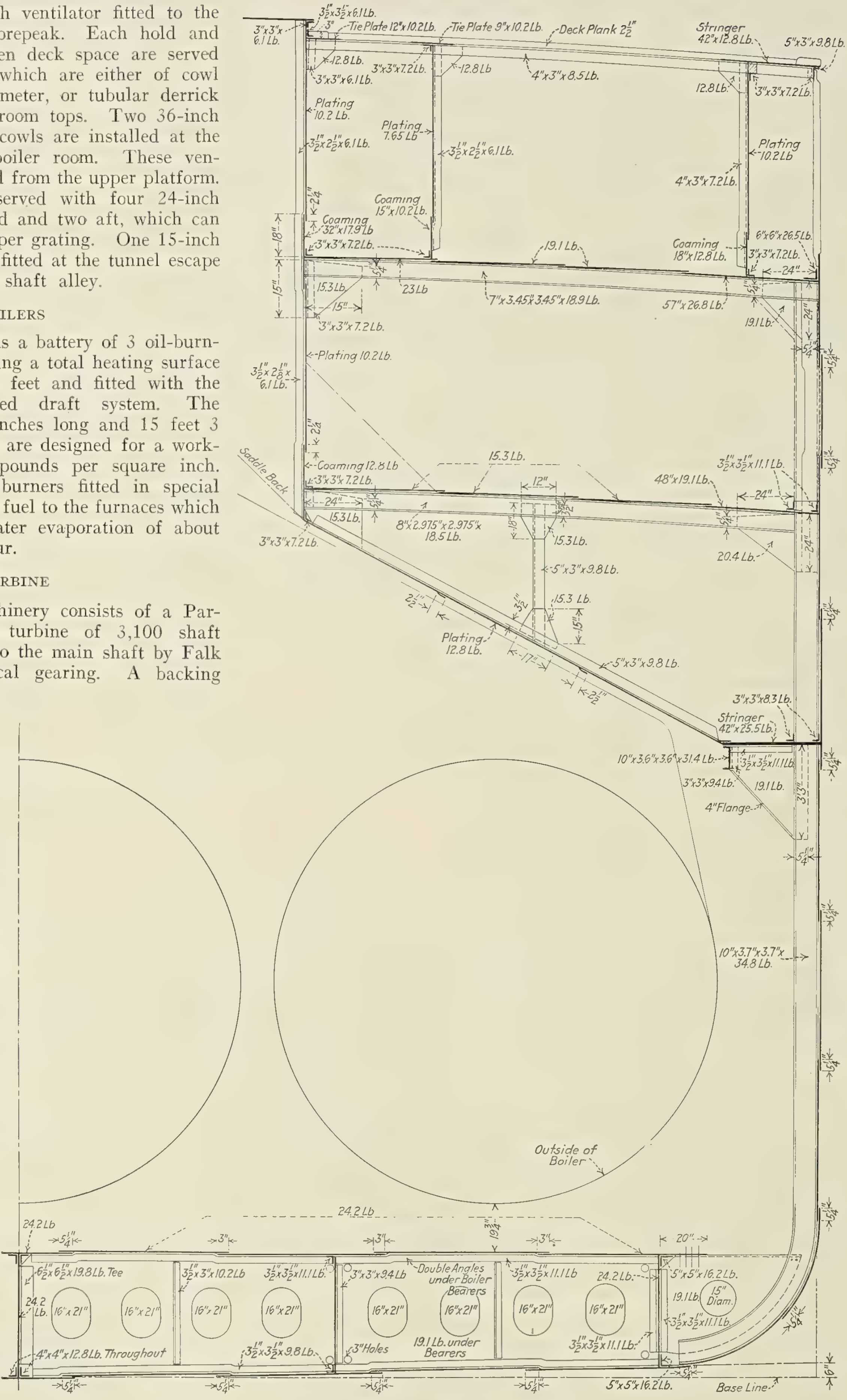
The fireroom contains a battery of 3 oil-burning Scotch boilers, having a total heating surface of about 7,836 square feet and fitted with the Howden heated forced draft system. The boilers are 11 feet 4 inches long and 15 feet 3 inches in diameter and are designed for a working pressure of 210 pounds per square inch. Todd mechanical oil burners fitted in special turret fronts supply the fuel to the furnaces which will give a normal water evaporation of about 45,000 pounds per hour.

Turbine

The propelling machinery consists of a Parsons cross compound turbine of 3,100 shaft horsepower connected to the main shaft by Falk double reduction helical gearing. A backing turbine is incorporated in the same casing as the ahead turbine which develops 50 percent of the maximum power with the same steam flow and one-half of the ahead full speed revolutions per minute.

The lubricating oil system is of the pressure type. Oil drains from the turbine and gears to a tank of about 600 gallons capacity located in the inner bottom. From there it is pumped through two Griscom-Russell Company coolers and an Elliott duplex strainer to the turbines and gears.

The auxiliary machinery, electrical equipment, propeller data and other interesting information are listed in the accompanying data sheet and further details and the arrangement of the vessel are indicated on the drawings.



Section Through Boiler Room

White Star Liner Pittsburgh Has Distinctive Features

Triple Screw Vessel of Intermediate Type Built for Moderate-Rate Service—Accommodations Comparable with Those of Express Liners

DESIGNED for the Boston-Queenstown-Liverpool service of the White Star Line, the steamship *Pittsburgh*, of 16,600 tons, is an outstanding example of the modern cabin-class ship, designed to meet a demand among persons of refined and discriminating tastes for ocean travel comforts of a superior kind at reasonable cost. She is one of the finest ships afloat for moderate-rate service.

With a length of 600 feet and a beam of 67 feet 6 inches, the *Pittsburgh* has a capacity for 600 cabin passengers, besides 1,700 in third class. Her public rooms are large and handsome. She has staterooms included in suites with private baths; an abundance of outside rooms; extensive promenade decks; a large and handsome lounge; a dining room beautifully decorated and fitted, with plenty of light, and perfectly ventilated; a smoking room comparing favorably with those of the largest ships; a gymnasium equipped with a variety of modern exercising apparatus, and a special playroom for children.

Propulsion is by Triple Screws

In construction and structural fittings, the *Pittsburgh* represents the same standard as the *Olympic*, the original *de luxe* liner of the White Star Line, which was built in the same yard as the new liner, that of Harland & Wolff, at Belfast, Ireland. The *Pittsburgh's* hull is subdivided into 14 watertight compartments and there are five completely plated decks, besides a promenade deck and boat deck.

An oil-burner, the vessel is equipped with triple screws, driven by two sets of reciprocating engines for the wing propellers, and a low pressure turbine for the center propeller.

Steam is supplied at 215 pounds per square inch working pressure by six oil fired double-ended Scotch boilers working under natural draft. The high pressure four cylinder triple expansion reciprocating engines have cylinders 28, 44, 49½ and 49½ inches diameter by 54 inches stroke. The low pressure turbine is of the Parsons reaction type.

A special feature of the machinery is the electrical installation, which includes power not only for electric lights, ventilating fans and elevators, wireless, watertight doors and various forms of equipment, but also for the steering gear and winches, which are electrically operated.

Public Rooms Are Spacious

As in most liners of recent construction, the *Pittsburgh's* chief public rooms are on the upper deck, and are lofty apartments, tastefully decorated and furnished.

A central foyer leading to the public rooms is decorated in white, the only color being supplied by doors of teak and a floor of warm-colored rubber tiles. In the wall over the landing of the staircase is a large picture with a view representing a scene in Pittsburgh. The balustrading of the staircase is painted white and is surmounted by a handrail of polished wood.

The largest public apartment is the lounge, decorated in delicate straw color, relieved by moldings and wreaths of pure white. A piano, and handsome card tables are to be found here. Palms and flower stands give an inviting atmosphere to the room, the corners of which are partly enclosed by glazed screens to form cozy retreats. There is an attractive fireplace in this room.

The writing room has a paneled wall in white with delicately modeled designs, after the style of the famous Adam Brothers. There are serviceable writing desks at various points and comfortable arm-chairs and curved seats flanking the fireplace set in a mantle of Maine marble. The furniture in this room of graceful design and pleasing color is made of birch, a characteristic American wood.

Dining and Smoking Rooms

The smoking room, in Queen Anne style, is panelled in French walnut, very simply and effectively wrought. There are ornamental stained glass windows and gilded sconces for the electric light fixtures placed in the center of various panels around the room. Chairs and seats are luxuriously upholstered in leather in a pleasing shade of blue. Ample table space is provided with groups of four chairs for card parties, if required, and isolated tables for writing purposes. The floor is covered with thick linoleum with lines of blue on a warm gray ground.

The dining room, two decks below, accommodates 400 at one sitting. It extends the full width of the ship and is fitted with tables seating two, four and six persons.

One of the distinctive apartments on the ship is the children's playroom. It is plainly paneled in oak, but enlivened by pictures illustrating the exploits of heroes and heroines of nursery legends. Toys and picture books are part of the equipment of this room.

In the gymnasium is found a chamber of old English type, with oak paneling, doors with diamond-shaped panes set in lead and equipped with iron locks, and details of finish in keeping with these features. The equipment by contrast is exceedingly modern, including apparatus for cycling, horseback riding, rowing, weight lifting, ball punching and hand ball.

Staterooms Are Attractive

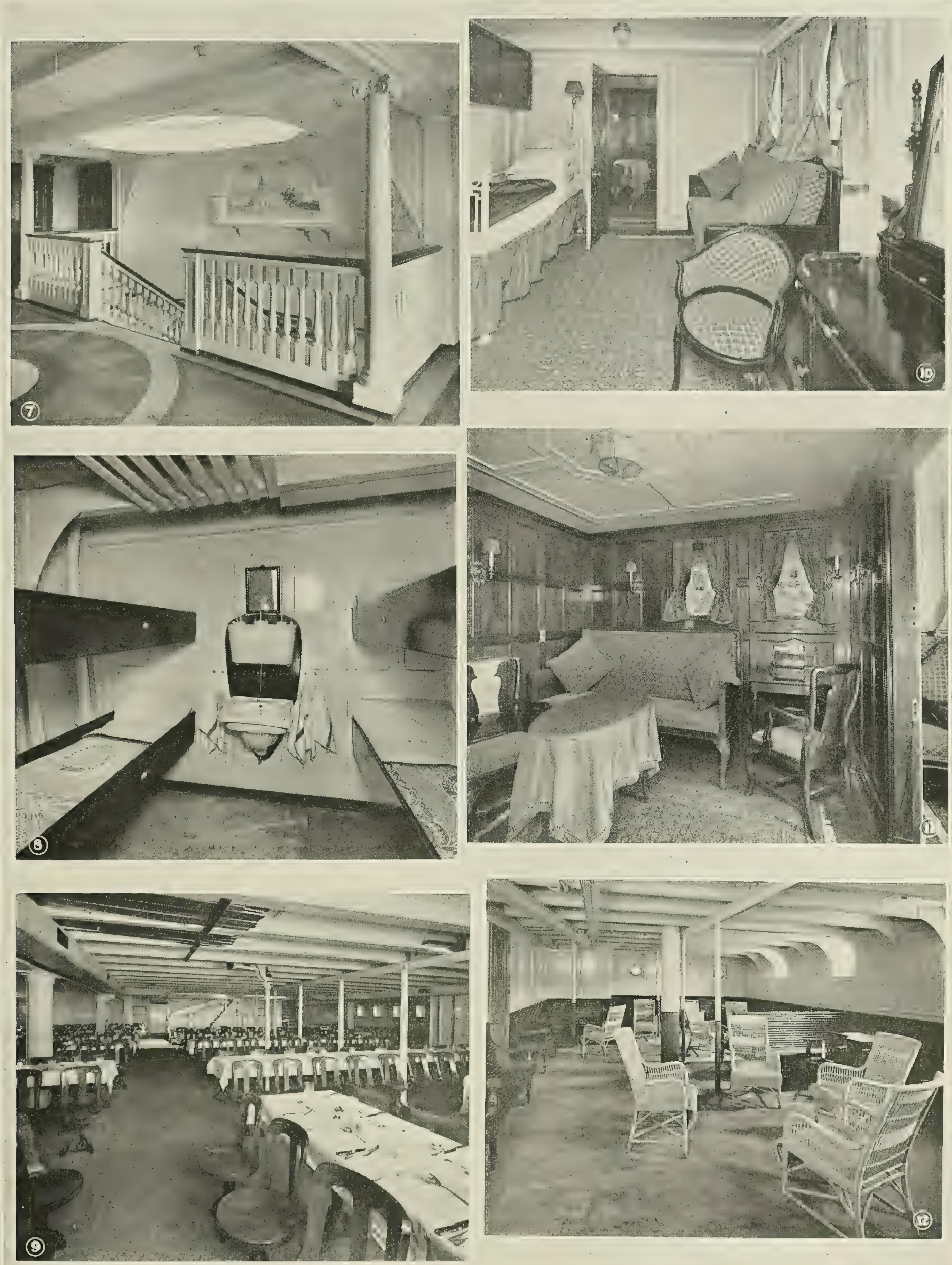
One of the *Pittsburgh's* most striking features is the variety of her staterooms, and the number which look out upon the promenade deck. Located amidship are suites which comprise one or two bedrooms, sitting room and bath room. This arrangement of apartments is an innovation for ships of the cabin class.

The sitting rooms in these suites are tastefully furnished and contain a writing table, a large lounge, a pedestal table and easy chairs. Their dimensions are 10 by 11 feet, and they have two windows looking out on deck, affording abundance of light and fresh air. The connecting bedrooms are 12 feet 6 inches by 11 feet, and each contains two bedsteads, a dressing table, wardrobe, chairs and electric heaters. The bedroom has two large windows, and off the bedroom is a white tiled bathroom with an outside window.

The remainder of the staterooms on this deck are outside rooms 9 by 11 feet, many of them connecting, furnished with four berths, thus affording desirable accommodations for families. Forward of the cabin entrance on this deck are a number of two-berth outside rooms each 6 by 10 feet, which is larger than the average stateroom.

On the upper deck are situated many two, three and four-berth rooms, including a number which are "L" shaped, having an inside dimension of 6 by 10 feet, and an extension to the outside of the ship, having an overall length of 4 feet. Many of these rooms are connected with adjacent two-berth rooms, so that if necessary individual parties may be accommodated in as many as four connecting rooms, having a total capacity of ten berths. On the same deck with these staterooms are 26 bath rooms and wash rooms.

Interior Views of White Star Liner Pittsburgh: (1) Lounge, (2) Smoking Room, (3) Gymnasium, (4) Reading and Writing Room, (5) Dining Room, (6) Children's Play-Room



Interior Views of White Star Liner Pittsburgh: (7) Head of Main Staircase, (8) Third-Class Four-Berth Stateroom, (9) Third-Class Dining Room, (10) Cabin Stateroom en Suite, (11) Cabin Sitting Room en Suite, (12) Third-Class Lounge

Motorship Missourian Leaving Cramp's Shipyard on July 10

Motorship Missourian Given Successful Tryout

Performance Proves That Standardization of Design and Accurate Workmanship Make It Unnecessary for a Diesel Engine to Undergo Extensive Shop Tests Before Installation in Vessel

By J. C. Shaw

On July 6 the motorship *Missourian,* which is a sister ship of the motorship *Californian* and owned by the American-Hawaiian Steamship Company, ran her builder's trial on the Delaware, returning to the yard of the Cramp Company the same day for completion before being turned over to her owners.

The owners were in a special hurry to have the vessel, which limited the time available for dock and preliminary trials, as they were desirous of putting her on the regular sailing date, which was scheduled for leaving Boston on July 15. This haste was due to a recent decision to lay up two of their steamers for repairs which were being employed on the combined coastwise and continental service.

The engine builder's preliminary trial, accordingly, consisted of a six-hour run down the Delaware and back, or a total of 12 hours.

During the preliminary trial, revolutions and cards were taken over a six-hour continuous run.

The oil-consumption trials were run in the open sea, on the way to New York, and when running between various ports for loading.

Results of Preliminary Trial

The results of a six-hour period of preliminary trial are as follows:

Starboard engine	116.65	revolutions per minute
Port engine	114.45	revolutions per minute
Mean, both engines	115.55	revolutions per minute
Starboard engine—M. I. P.	83.34	pounds per square inch
Port engine—M. I. P.	86.19	pounds per square inch
Starboard engine	2,221	indicated horsepower
Port engine	2,258	indicated horsepower
Both engines	4,479	indicated horsepower

The shallow water, in combination with the drag of the vessel due to the trim aft, had the effect of simulating loaded conditions, as it will be noted that the engines on an average developed approximately their rated power at normal revolutions, which is 4,500 indicated horsepower at 115 revolutions per minute. At the turn where the water was deeper, however, the revolutions and corresponding power were considerably above the mean values, though the control levers on the engines were not altered.

The draft on the trial, taken in fresh water, and with the inner bottom oil tanks filled with oil and the peak tanks partly filled with water, was 8 feet 1 inch forward and 17 feet 9 inches aft, or a mean of 12 feet 11 inches, corresponding to 6,579 tons displacement.

On July 10 the *Missourian* left the Cramp Company's yard for New York to dock for bottom painting, and on the 12th proceeded to Boston to commence loading, where about 700 tons of cargo were put aboard. She then went directly to Philadelphia for additional cargo, where about 3,000 tons were taken on. Afterwards she returned to New York to finish loading. From the last mentioned place she finally sailed on July 23 for the Pacific Coast.

Much fog was encountered on the way to and from Boston, when rounding the New England coast, necessitating slowing down at times, and taking the longer outside passage, via Nantucket Light. The average speed, however, on the way up to Boston, from Ambrose to Boston Light, was 12.97 knots, and on the return from Boston Light to Overfalls (or entrance to Delaware Bay) 12.89 knots.

Oil Consumption Very Consistent

The first four columns in the accompanying table show the summary of the results obtained between the different ports before leaving for the West Coast. The data in the last column were obtained by radio on the second day out, after leaving New York for the Panama Canal. From these

Sea Trials on Motorship Missourian, July, 1922

Date of trials	7/10, 11	7/12, 13	7/15, 16, 17	7/20/22	7/24-7/25
Run between	Phila.	New York	Boston	Phila.	New York
and	New York	Boston	Phila.	New York	Panama
Draft, for'd	9′ 4″	7′ 3″	10′ 0″	13′ 5″	......
Draft, aft	16′ 2″	18′ 2″	17′ 8″	23′ 10″	......
Draft, mean	12′ 9″	12′ 8½″	13′ 10″	18′ 7″	23′ 1″
Displacement, tons	6,705	6,678	7,347	10,213	13,000
Consumption test duration	3 hrs.	2 hrs.	10 hrs.	5 hrs.	24 hrs.
R. P. M. st'b'd engine	121.64	124	121.91	114.59	......
R. P. M. port engine	118.63	121.96	119.90	112.21	......
R. P. M. mean	120.9	122.98	120.90	113.40	114
M. I. P. lbs., per sq. in., st'b'd engine	93.02	87.47	87.90	82.78	......
M. I. P. lbs., per sq. in., port engine	89.04	86.33	85.62	88.18	......
M. I. P. lbs., per sq. in., mean	91.03	86.90	86.76	85.48	85.20
I. H. P. st'b'd engine	2 588	2,477	2,450	2,170	......
I. H. P. port engine	2,415	2,410	2,347	2,266	......
I. H. P. two engines	5,003	4,887	4,797	4,436	4,440
Oil per I. H. P. main engines, all purposes	.309	.312	.304	.306	.307
Oil per hr., lbs., all purposes	1,545	1,525	1,459	1,357	1,363
Speed trial measured between	NE Light	Ambrose	Nantucket	Overfalls	......
and	Ambrose	Fire Isl.	NE Light	Ambrose	......
Knots	12.45	13.93	13.27	12.42	......
R. P. M. st'b'd engine	......	120.84	......	113.89	......
R. P. M. port engine	......	121.20	......	111.70	......
R. P. M. mean	115.3	121.02	121.	112.8	......
Slip, percent	6.8	.8	6.4	5.	......

figures it will be noted that the total oil consumption per indicated horsepower, main engines only, is very consistent and checks quite closely the results obtained with the motorship *Californian*, previously published.

The set of cards shown was obtained on the final run from Philadelphia to New York, when partly loaded. The only adjustment which had been made to the engines, affecting the character of the cards, since erection in the vessel, was to slightly advance the fuel cam throws on cylinders Nos. 2 and 4 of the port engine. The mean indicated pressures of the various cylinders had not yet been equalized, as this was to be carried out after leaving New York by the Cramp Company's guarantee engineer, Mr. O. Mattson, who accompanies the vessel on the first voyage.

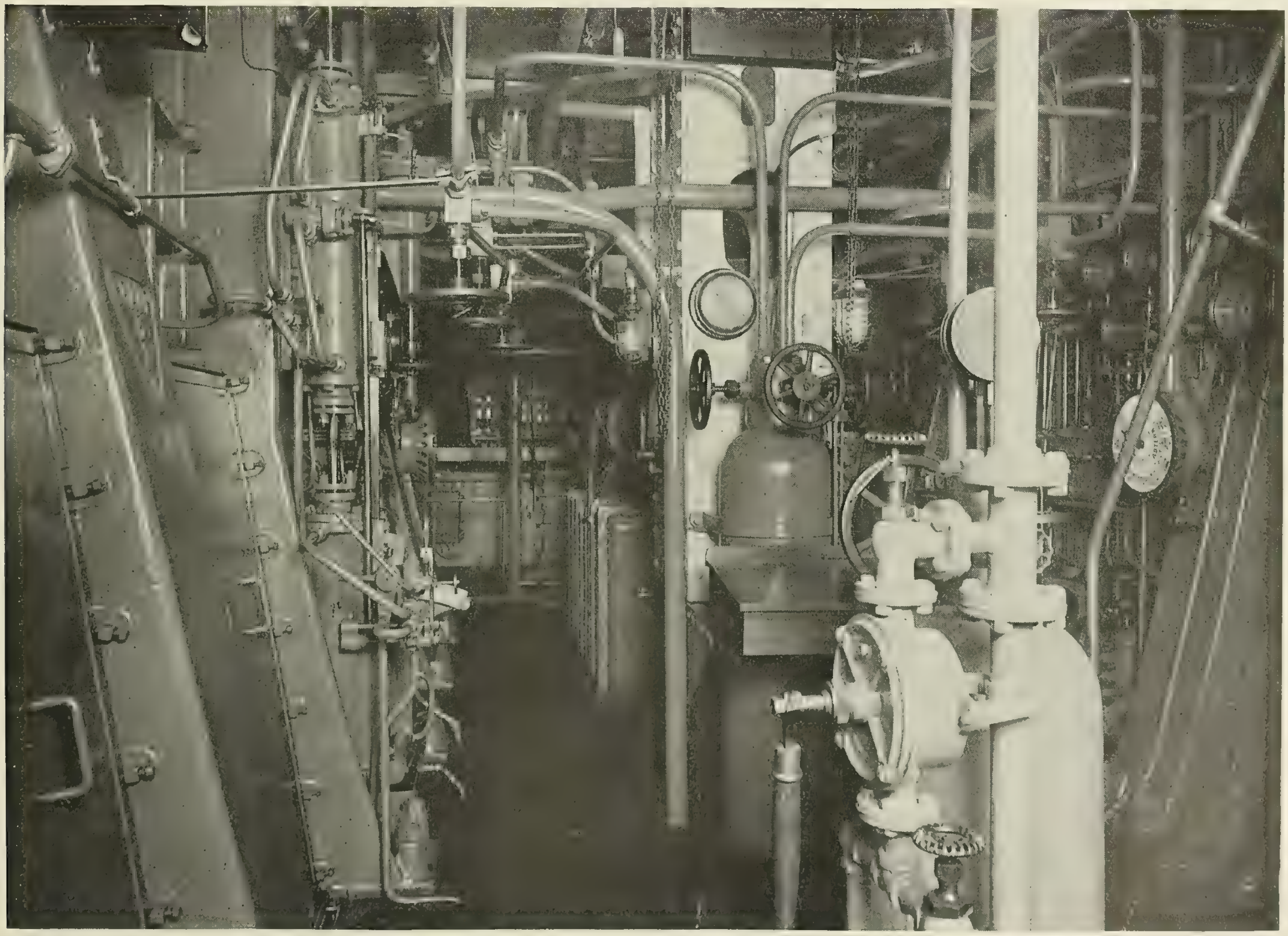
The engines were remarkably free from vibrations at all times, although the vessel was in light condition, and the revolutions of the propellers at times considerably exceeded the designed revolutions of the engines.

Carries Oil For Round Voyage

The oil, which was used on the trials, and of which sufficient is being carried for the round voyage to the Pacific Coast, returning via Panama and Europe, is the same as that furnished the motorship *Californian*. This was supplied by the Texas Company (known as Port Arthur Light Fuel), and shows the following analysis:

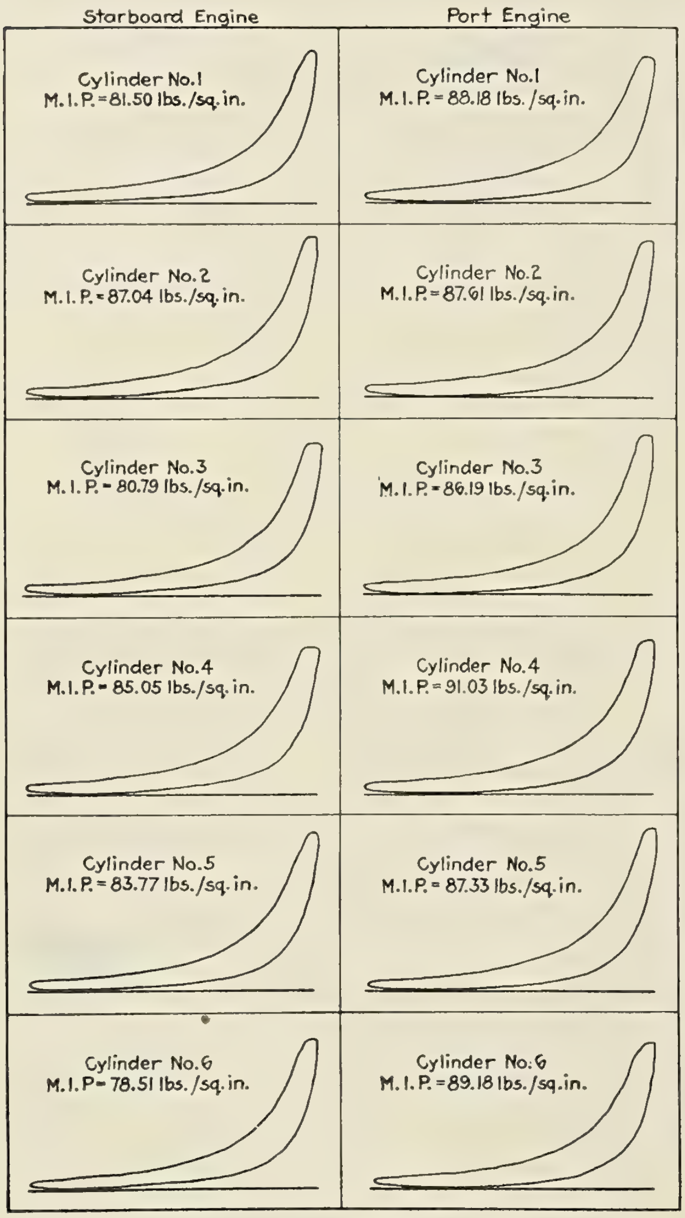
Specific gravity at 60 degrees F	.913
Be., corresponding	23.5 degrees
Flash, open cup	253 degrees F.
Fire	273 degrees F.
Viscosity. Saybolt universal	152
Sulphur—percent	.60
Hard asphalt, percent, insoluble in naphtha	1.11
British thermal units, higher heating value	19,120

The motorship *Missourian* is identical as to hull and machinery with the motorship *Californian* with the exception of



Engine Room of Motorship Missourian, Port Side, Looking Forward, Showing Operating Platform

the deck machinery. The *Californian* has fourteen winches built by the American Engineering Company, and the *Missourian* fourteen winches of similar design, but supplied by the Maine Electric Company. Both vessels, however, have two winches of the Sheppard planetary gear design located at after end of No. 2 hatch. The windlass and hydro-electric steerer are the same for either vessel, being supplied by the American Engineering Company. The chief difference in the deck machinery is that the *Missourian's* electrical equipment



Indicator Cards Show Uniform Performance of Engines

was supplied by the General Electric Company, while that of her sister ship, being the same as the motorship *William Penn,* was furnished by the Westinghouse Company. In equipping the *Missourian's* deck machinery with the General Electric apparatus it was the desire of the owners to try out the equipment of these two well-known electrical companies in a competitive way, as much of the success of the motorship as a whole depends on the reliability and efficiency of the electrical accessories, and this applies to the winches in particular.

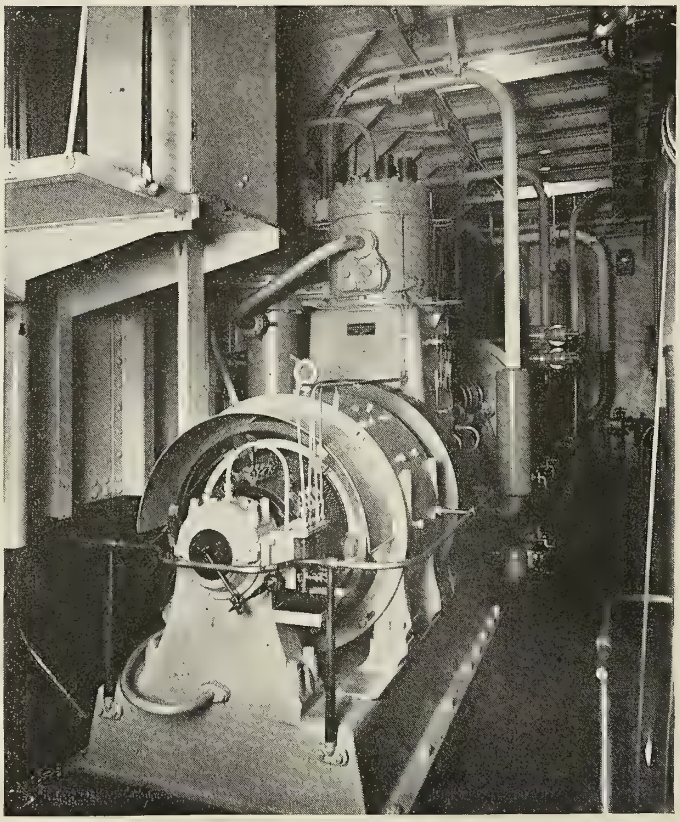
The hull of the *Missourian,* like that of the *Californian,* was built at the yard of the Merchant Shipbuilding Corporation at Chester, Pa., and towed to Cramp's yard for installation of the machinery.

View in Engine Room at Upper Grating, Port Side, Looking Forward, Showing Cross Girder and Vertical Column

No Time Lost

The port engine was turned over for the first time under power on July 1, and the starboard engine the following day. On the 4th no work was done, it being a holiday, and on the 6th the vessel carried out her 12-hour preliminary trial, as previously stated. This is an accomplishment worthy of mention and speaks well of the standardization in design and accuracy of workmanship attained by special production methods, and completely refutes the general impression that it is necessary that a Diesel engine undergo elaborate shop tests before being installed in the vessel.

The American-Hawaiian Steamship Company has the distinction among American private shipowners of having the



Starboard Side of Engine Room, Looking Aft. Auxiliary Air Compressor in the Foreground

first two all-American built motorships of large size, and comparable with the motorships abroad that are being built in considerable numbers. These vessels are being run on a route, on scheduled sailings, in conjunction and in competition with their fastest and best freight steamers. American shipowners, accordingly, should follow with keen interest the performance of these motorships in service.

The master of the motorship *Missourian* is Captain R. M. Tapley, and the chief engineer Mr. Henry Timmer, both veterans in the service of the American-Hawaiian Company.

Striking Features of Motorship Building in Europe

Development of the Long-Stroke Engine—Diesel Electric Motorships—British Designers Adopting Engines to Run on Boiler Oil

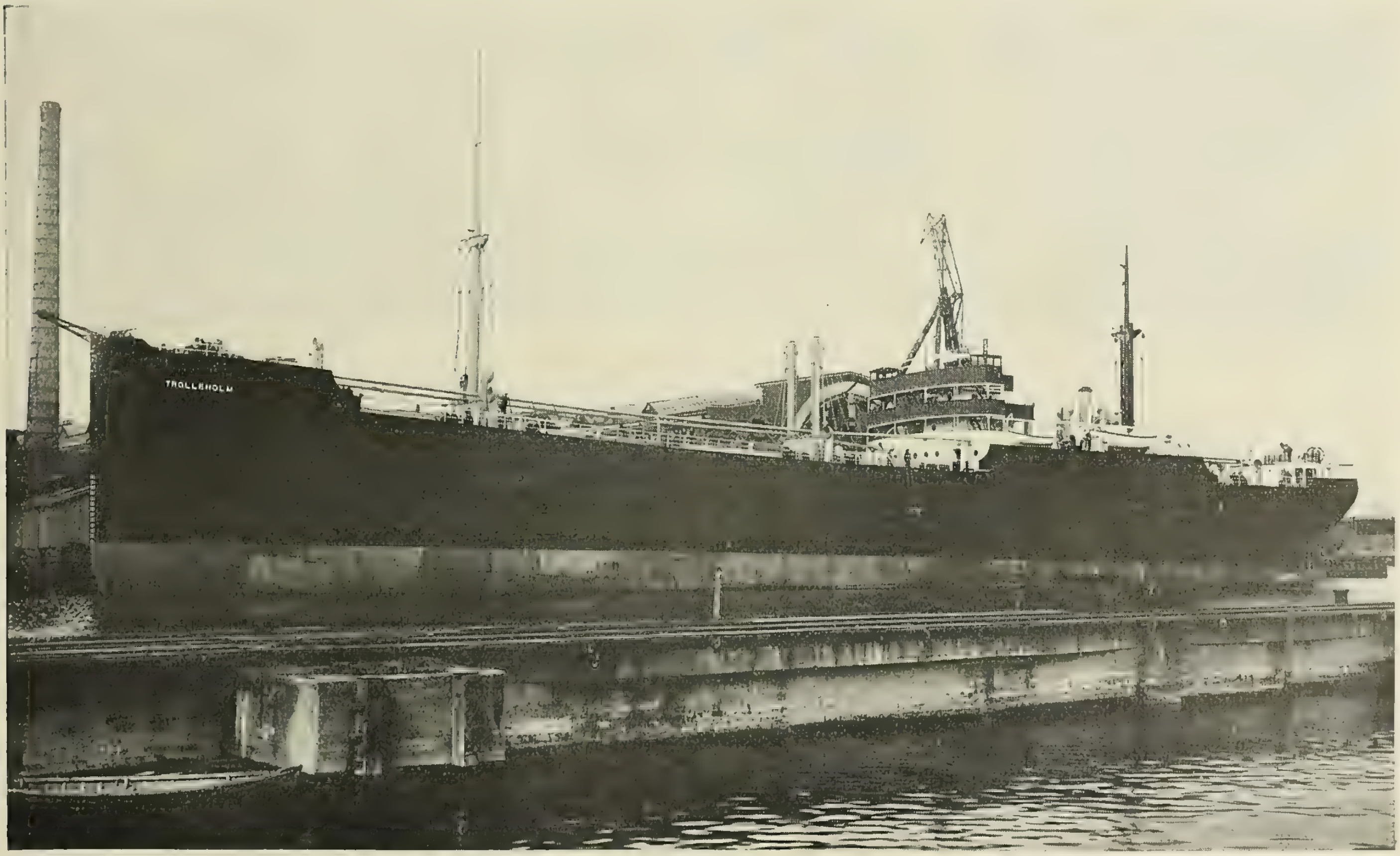
By Our Special London Correspondent

ONE of the most interesting lines of progress of marine oil engine construction in Europe during the past year, has been the development of the long-stroke motor. This is in consequence of a demand that has naturally arisen among shipowners for single screw vessels, more particularly in cases where the power of the machinery required does not exceed about 2,000 horsepower. By the adoption of this design, speeds of revolution can be kept down to a figure commensurate with those employed on single screw steamers, as the modern long-stroke Diesel engine is designed to run at about 75-90 revolutions per minute.

In spite of the depressing shipping situation, quite a number of orders for oil engined vessels have recently been placed, and among these are contracts for five ships to be provided with single screw plants. A short time ago it was considered desirable to install twin engines if only from the standpoint of reliability, but no doubt the success of the Doxford engined vessels and other single screw motor craft, has caused shipowners to change their policy in certain cases.

Hence the latest motor liner for the Holt line, which has just been laid down, and which is a 10,000 ton ship, will be equipped with the largest Burmeister & Wain long-stroke engine that has yet been built. It will develop 3,000 horsepower in eight cylinders, and run at about 85 revolutions per minute. The stroke bore ratio will be rather more than 2 instead of 1.5 to 1.6, and other new features in design will include the extension of the long vertical steel bolts to the tops of the cylinder covers, whereas in the normal arrangement, they only reach to the top of the cylinder barrels.

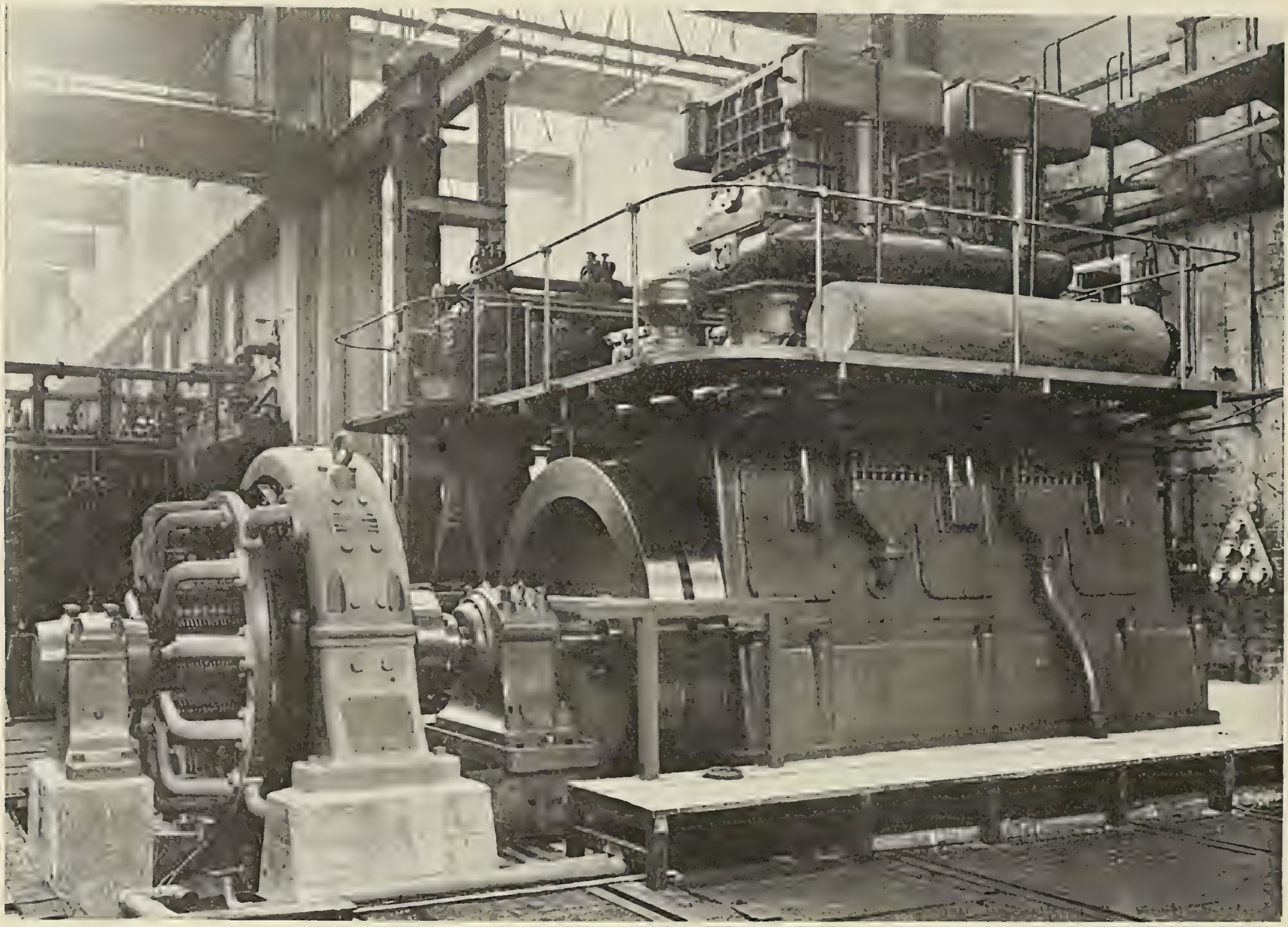
Another alteration lies in the adoption of a means for varying the lift of the fuel valve, according to the speed of rotation, this usually being considered unnecessary with short-stroke Burmeister & Wain engines. It will be remembered that the William Cramp & Sons' Ship and Engine Building Company is also constructing one of these long-stroke Diesel motors with the object of converting an existing steamer; and an order for three further ships has recently been placed on the Clyde for which Messrs. J. G. Kincaid and Company will supply the machinery.



The New 7,500-Ton Motorship Trolleholm

Diesel Electric Motorships

As a marine engineering proposition, the propulsion of ships on the Diesel electric system is of unusual interest. Messrs. Cammell Laird and Company, which has developed the Camellaird Fullagar engine with opposed pistons, has taken up the problem of the Diesel electric drive, and has received an order for three ships embodying this system, for the United Fruit Company. There will be no fewer than four generating sets installed in the engine-room, developing a total of 3,400 brake horsepower and the electric motors will drive the propellers direct at a relatively low speed. The engines will not differ from the Camellaird Fullagar marine design which is now so well-known, except in certain details, but they will operate at much higher speeds, probably at about 250 revolutions per minute.



The Camellaird-Fullagar Diesel Generating Set. Four Units are To be Installed in Motorships for the United Fruit Company

One of the licensees of Messrs. Cammell Laird and Company, the English Electric Company, has already developed a stationary Camellaird Fullagar engine, of which an illustration is published, and the sets installed in the new ships will not show any marked variation from this construction, although they will be of somewhat higher power. A specially sensitive governor is provided, and the somewhat peculiar features of the Camellaird Fullagar marine engine will be embodied, including a square section scavenging pump, arranged at the top of each cylinder. The absence of reversing mechanism will of course render the design very simple and it is believed that in spite of the electrical gear, a considerable reduction of weight will be effected as compared with an ordinary marine equipment.

The reductions in the prices of liquid fuel at British ports, which have recently been announced, will undoubtedly give a fillip to the motorship industry. Diesel oil is quoted at £4 per ton at British ports, and boiler fuel at £3 per ton, and it is evident that, especially for those motorships equipped with machinery which can operate on the heavier and cheaper oils, the possibilities of effective competition by steamers are remote. Hence, it is not surprising that builders of marine oil engines are making every endeavor to design their motors so that they will operate satisfactorily and continuously on the low grade fuel.

The performance of one of the Doxford engined ships, the *Dominion Miller,* is interesting in this connection. On a long run at a speed of 11½ knots, boiler oil was used exclusively, the amount consumed being 10½ tons daily for a vessel with a deadweight of between 9,000 and 10,000 tons. No special precautions appear to have been taken except that heating coils are provided to render the oil sufficiently liquid to flow under all conditions. Obviously if one type of engine proves that it will burn boiler oil with complete satisfaction, makers of other designs will have to guarantee equal performance for their motors, since the saving in the fuel bill at present prices amounts to quite 30 percent.

The Motorship "Trolleholm"

Motorship building in Scandinavia seems to be boiling itself down to the development of a limited number of standard types, since both shipowners and engine builders are desirous of obtaining the advantages which can be derived by repetition construction in marine oil engines. The latest example of one of these classes of standard ship is the *Trolleholm* built for the Swedish American Mexico Line and engined by Burmeister & Wain.

She has a deadweight of about 7,500 tons, is 367 feet in length between perpendiculars with a molded breadth of 51 feet 3 inches and a draft of 24 feet 8½ inches. Two engines are installed, totalling 2,100 indicated horsepower, the speed of rotation being unusually high, namely 150 revolutions per minute. This class of ship appears to have given very satisfactory service, since when fully laden and averaging 10½ knots, the total consumption does not exceed 8 tons for all purposes. The usual electrical equipment is provided, the donkey boiler being only used for heating purposes. Ten three-ton winches are fitted, and the steering gear and engine-room auxiliaries are driven by electric motors.

Stability of Ships at Large Angles of Inclination*

Explanation of Matrosov's Stability Calculations—Application to Lumber Carrying Steamer—By Tabulation, Work Is Reduced to Simple Arithmetic

By P. Jankov

IT is generally considered that stability calculations for "small angles of inclination" hold good for angles up to 10 degrees, but when a ship is inclined to such an angle that the side of the weather deck becomes immersed, the volumes of the "in" and "out" wedges become different,

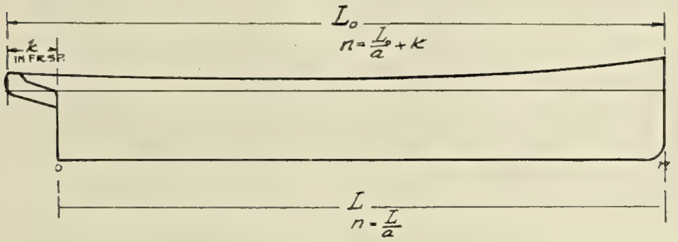


Fig. 1

and the displacement becomes greater or less depending on whether the "in" or the "out" wedge, respectively, becomes greater and the other wedge less. The change in the volume of the submerged hull is accompanied by a change in the location of the center of buoyancy C_0. Thus the

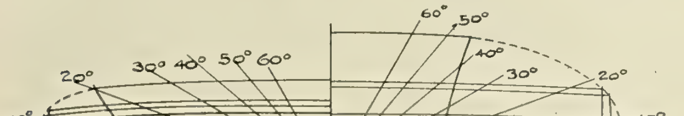


Fig. 2

distance between C_0 and the center of gravity of the ship G_0 is also changed. The change in the area of the load water plane affects the position of the metacenter M_0 in one direction or the other. In brief, the relative locations of all the three significant points change when the angle of inclination becomes great.

To estimate the stability of the ship at greater angles of inclination according to the methods ordinarily in use, it is necessary to perform numerous long and laborious calculations, and this work is further increased if it is desired to find the stability for several different conditions of loading. But great saving of time is effected by using the method described below, the development of which is credited to A. Matrosov, a Russian naval architect, and which is said to have been in use in all the larger Russian shipyards. The procedure is exceedingly simple and, if the work is

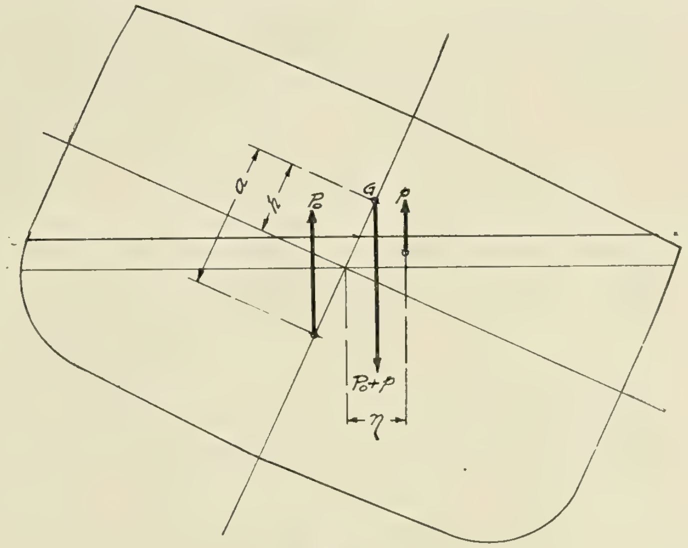


Fig. 3

tabulated as here indicated, it becomes reduced to simple arithmetic.

Matrosov's method for calculating stability is especially valuable for ships intended to carry lumber cargoes, since the stability calculations for the normal load waterline will not apply when the ship is loaded to the smaller freeboard permissible in many trades in lumber, especially when a deckload is carried. For this reason Matrosov's method is here explained using as an example a lumber-carrying steamer of 3,323 tons displacement at 18 feet 6 inches draft, the length being 240 feet. There are 128 frame spaces of 1.875 feet each.

MATROSOV'S METHOD

The center of gravity of the ship G_0 is found by trial, after which the lever arms for different angles of inclination may readily be calculated by means of Table VII, and the static stability diagram may be drawn.

For these calculations it is necessary to have a line drawing of the ship and to know the displacement P_0 or the draft

*Translated from Teknisk Ukeblad by John Flodin.

TABLE I

I No. OF SECTION	II ABSCISSAE FOR TCHEBYCHEFF'S SECTIONS FROM A.P.	III ABSCISSAE IN FRAMES P. = II × n	IV ABSCISSAE IN FEET FROM A.P. = $\frac{L}{n}$ (III−K)
1	0.444	5.6	10.5
2	0.200	25.6	48.0
3	0.236	30.2	56.6
4	0.416	53.3	100.0
5	0.500	64.0	120.0
6	0.584	74.7	140.0
7	0.764	97.8	183.4
8	0.800	102.4	192.0
9	0.956	122.4	229.5

TABLE A

SEC'N No.	7WL	6WL	5WL	4WL	3WL	2WL	1WL	
1	9.60	6.00	3.40	2.20	1.50	0.90	0.40	
2	17.20	16.90	16.30	15.30	13.50	10.10	3.00	
3	17.60	17.40	17.10	16.50	15.20	12.40	5.00	
4	17.90	17.95	18.00	18.00	17.85	16.80	10.00	
5	17.90	17.95	18.00	18.00	17.95	17.10	10.00	
6	17.90	17.95	18.00	18.00	17.90	16.80	10.00	
7	17.20	17.10	17.00	16.60	15.80	13.60	7.00	
8	16.50	16.35	16.10	15.60	14.50	12.10	5.50	
9	6.30	5.70	5.10	4.30	3.40	2.25	0	
	138.10	133.30	129.00	124.50	117.60	102.05	50.90	
	$\frac{1}{2}$	2	1	2	1	2	$\frac{1}{2}$	
	69.05	266.60	129.00	249.00	117.60	204.10	25.45	$\Sigma_o=1060.8$
	6	5	4	3	2	1	0	
	414.3	1333.0	516.0	747.0	235.2	204.1	0	$M_o=3449.6$

$$C_o=\frac{M_o h}{\Sigma_o}=\frac{3449.6}{1060.8}\times\frac{18.5}{6}=10'.03$$

$$P_o=2\cdot\frac{2}{3}\cdot\frac{H_o}{6}\cdot\frac{L}{9}\cdot\Sigma_o:35=\frac{2}{81}\cdot\frac{18.5\times240\times1060.8}{35}=3323 \text{ tons}$$

TABLE VII

FOR LUMBER CARGO: H = 18'-6" + 7" = 19'.08

$P_1=3445;\ c_1=10.34;\ g_1=14.34;\ p_1=122;\ a_1=4.00;\ h_1=-4.16$

I $P_o a_1 \sin\varphi$	II $(M-n)^*-I$	III $h_1 \sin\varphi$	IV $\eta-III$	V $IV\times p_1$	VI $II+V$	VII $VI\div P_1$ =ARM IN FT.	$\varphi°$
2307	1148	−0.72	0.88	107	1255	0.36	10
4545	1920	−1.42	−0.57	− 70	1850	0.54	20
6640	1750	−2.08	−2.17	−265	1485	0.43	30
8540	1075	−2.68	−3.01	−367	708	0.21	40
10180	330	−3.19	−2.99	−365	− 35	−0.01	50
11510	− 580	−3.60	−2.60	−317	− 897	−0.26	60

*(M−n) From col. II. Table VI

TABLE VIII

FOR N. ATLANTIC, WINTER: H = 18'-6" − 2" = 18'.33

$P_2=3288;\ c_2=9.94;\ g_2=13.5;\ p_2=35;\ a_2=3.56;\ h_2=-5.00$

$\varphi°$	I $P_o a_2 \sin\varphi$	II $(M-n)^*-I$	III $h_2 \sin\varphi$	IV $\eta-III$	V $IV-p_2$	VI $II+V$	VII $VI-P_2$ =ARM IN FT.
10	2052	1403	− 0.87	1.03	− 36	1367	0.42
20	4045	2420	− 1.71	−0.28	10	2430	0.74
30	5915	2475	− 2.50	−1.75	61	2536	0.77
40	7605	2010	− 3.21	−2.48	87	2097	0.64
50	9060	1450	− 3.83	−2.35	82	1532	0.47
60	10250	680	− 4.33	−1.87	65	745	0.23

H_o. Before column III, Table I, is filled in, which column gives the locations of Tchebycheff's sections, it is necessary carefully to choose the length of the ship (see Fig. 1), which is given by the number of frames and distance between frames ($n = L_o/a$, where a is the length of the frame space).* This is necessary because the length of L_o is not necessarily equal to the length between perpendiculars, so that a correction k may have to be made (e. g., for a ship with a long cruiser stern).

The length decided on is multiplied by the coefficients given in Column II, which are the abscissæ corresponding to Tchebycheff's sections, expressed in thousandths of the length of the ship, from the after perpendicular. Column IV gives these abscissæ in feet.

From the lines are worked up the sections for Tchebycheff's rule (see Fig. 2), nine half-sections to a ½-inch scale in general being satisfactory. All the sections must be closed by drawing in the line of the uppermost watertight deck. Now the four fundamental quantities are taken off the lines for each condition of loading, such as full load, ballast and other conditions, and are entered in their proper positions in the tables, namely, the displacement P_o, the height of the center of buoyancy C_o, and the length L_o at draft H_o. In case only the draft is known, the displacement P_o and the position of the center of buoyancy may be found as indicated in Table A, where the summation is done by means of Simpson's and Tchebycheff's rules. From this table the displacement curve may be drawn up in the ordinary manner.

On the body plan giving Tchebycheff's sections, waterlines for inclinations for every tenth degree up to 60 degrees (continuation of this work up to 90 degrees is of no practical value) are now drawn through the intersection of the normal load waterline and the center line, which brings us to Table II. This table is divided in an upper and a lower part, the upper part containing the ordinates of the water planes for the various inclinations, the squares and cubes of the ordinates and the sums of the vertical columns for the immersing side of the ship; while the lower part of the table gives the corresponding values for the emerging side. The ordinates are scaled off the body plan (Fig. 2), in general, sufficient accuracy is obtained, if the ordinates are read to one decimal place, their squares entered in whole numbers only and their cubes to the nearest ten.

In connection with Table III attention should be called to the fact that columns IV, IX and X are used for calculating the principal moment M, while the other columns serve for estimating relatively minor moments n, the computing of which does not require so high a degree of accuracy. Columns II and IV contain, respectively, the sums of Σy and Σy^3 from the upper and lower parts of Table II, and column III gives the difference $\Sigma y_1^2 - \Sigma y_2^2$ from Table II. Column V contains the products of the values in column II multiplied by $\lambda = L_o/a$, giving areas of the water planes.

Of course, the water plane areas as found do not check with the actual values, since the water planes do not have a common point of intersection. On account of the difference between the volumes of the emerging and immersing wedges, the actual water planes will lie above or below and be greater or less than those drawn; but the error in the areas of the water planes may be disregarded without undue sacrifice of accuracy. Column VI gives the static moments of the water planes with reference to an axis that coincides with the intersection of the load waterline and the longitudinal

*This is based on uniform frame spacing. Where frame spacing is not uniform, the method should be modified to suit conditions.—Translator.

TABLE II

		0°			10°			20°			30°			40°			50°			60°		
IMMERSING SIDE OF HULL	NO. SEC.	y_1	y_1^2	y_1^3	y_1	y_1^2	y_1^3	y_1	y_1^2	y_1^3	y_1	y_1^2	y_1^3	y_1	y_1^2	y_1^3	y_1	y_1^2	y_1^3	y_1	y_1^2	y_1^3
	1	9.6	92	885	12.3	151	1860	15.3	234	3580	11.6	135	1560	9.2	85	779	7.7	59	457	6.8	46	314
	2	17.2	296	5090	17.6	310	5450	12.8	164	2100	9.0	81	729	7.1	50	358	5.9	35	205	5.3	28	149
	3	17.6	310	5450	17.8	317	5640	12.3	151	1860	8.6	74	636	6.8	46	314	5.7	32	185	5.0	25	125
	4	17.9	320	5740	18.1	328	5930	10.8	117	1260	7.6	58	439	6.0	36	216	5.0	25	125	4.5	20	91
	5	17.9	320	5740	18.1	328	5930	10.8	117	1260	7.6	58	439	6.0	36	216	5.0	25	125	4.5	20	91
	6	17.9	320	5740	18.1	328	5930	10.8	117	1260	7.6	58	439	6.0	36	216	5.0	25	125	4.5	20	91
	7	17.0	289	4910	17.3	299	5180	15.2	231	3510	10.8	117	1260	8.5	72	614	7.2	52	373	6.4	41	262
	8	16.5	272	4490	16.8	282	4740	16.1	259	4170	11.5	132	1520	9.0	81	729	7.6	58	439	6.7	45	301
	9	6.3	40	250	6.7	45	301	7.3	53	389	8.2	67	551	10.1	102	1030	11.5	132	1520	10.3	106	1090
	Σ_1	137.9	2259	38295	142.8	2388	40961	111.4	1443	19389	82.5	780	7573	68.7	544	4472	60.6	443	3554	54.0	351	2514
EMERGING SIDE OF HULL	NO. SEC.				y_2	y_2^2	y_2^3	y_2	y_2^2	y_2^3	y_2	y_2^2	y_2^3	y_2	y_2^2	y_2^3	y_2	y_2^2	y_2^3	y_2	y_2^2	y_2^3
	1				8.1	66	531	7.2	52	373	6.7	45	301	6.5	42	275	6.6	44	287	7.1	50	358
	2				17.2	296	5090	17.4	303	5270	17.7	313	5550	18.2	331	6030	18.4	339	6230	18.4	339	6230
	3				17.8	317	5640	18.2	331	6030	18.9	357	6750	19.7	388	7650	19.8	392	7760	19.6	384	7530
	4		AS ABOVE		18.3	335	6130	19.2	369	7080	20.8	433	9000	22.7	515	11,700	22.6	511	11540	21.0	441	9260
	5				18.3	335	6130	19.2	369	7080	20.8	433	9000	22.8	520	11,850	22.7	515	11700	21.0	441	9260
	6				18.3	335	6130	19.2	369	7080	20.8	433	9000	22.7	515	11,700	22.6	511	11540	21.0	441	9260
	7				17.3	299	5181	18.0	324	5830	19.1	365	6970	20.2	408	8240	20.5	420	8620	20.1	404	8120
	8				16.6	276	4570	17.2	296	5090	18.1	328	5930	19.0	361	6860	19.6	384	7530	19.5	380	7410
	9				6.2	38	238	6.3	40	250	6.5	42	275	7.1	50	358	8.0	64	512	9.4	88	831
	Σ_2				138.1	2297	39669	141.9	2453	44083	149.4	2749	52776	158.9	3130	64663	160.8	3180	65719	157.1	2968	58259

DISPLACEMENT P_0=3323 TONS; CORRESP. DRAFT-H_0=18'-6"; CR. OF BUOYANCY ABOVE KEEL = C_0 = 10'.03;

C.G. ABOVE KEEL = g_0 = 13'.5; LENGTH OF SHIP = L_0 = 240'-0"; $\lambda = \frac{L_0}{9} = 26'.67$; $\frac{1}{2}\lambda = 13.33$. $\frac{1}{3}\lambda = 8.89$;

$\phi = \frac{\pi}{18} = 0.1745$; $\frac{1}{2}\phi = 0.0873$

center plane. The figures are obtained by multiplying the values given in column III by $\frac{1}{2}\lambda = L_0/18$.

By dividing the values of column VI by the corresponding values in column V, we obtain the distance η of the center of gravity of the water plane from the above axis, the quotients being given in column VII. Column VIII contains the values of $\frac{1}{2}\lambda$ $\frac{1}{2}\phi$ $(\Sigma y_1^2 - \Sigma y_2^2)$, which gives one-half of the volumes of the emerging wedges for the various angles of inclination. The moments of inertia of the water planes of inclination, $I = 1/3\lambda$ $(\Sigma y_1^2 + \Sigma y_2^3)$ are given in column IX, and the moments of the angles of inclination, or the products $I\phi$, are given in column X.

The principal moment M is found as shown in Table IV. The second column is taken from column X, Table III, the values are multiplied by the cosines of the angles of inclination (given in the third line from the bottom), and the products are entered as indicated. When all the triangles have been filled, the products are added diagonally. These calculations may be indicated thus:

In the third column, $\frac{1}{2}m_{60\text{ deg.}}$, $\frac{1}{2}m_{50\text{ deg.}}$, $\frac{1}{2}m_{40\text{ deg.}}$ ..... $\frac{1}{2}m_{0\text{ deg.}}$ In the second column, $.985m_{50\text{ deg.}}$, $.985m_{40\text{ deg.}}$ ....$.985m_{0\text{ deg.}}$, etc. And the summation, $M_{60\text{ deg.}} = \frac{1}{2}m_{60\text{ deg.}} + .985_{50\text{ deg.}} \ldots + .500m_{0\text{ deg.}}$, etc., which sums are entered in the last line of the table. These sums are the resulting righting moments at the various degrees of inclination.

Table V is used for finding the correction moment n due to the difference in the volumes of the emerged and immersed wedges. In line III are entered the figures from column VIII, Table III, and in line II the same figures are entered but here they are transposed so that the value given for any stated angle of inclination is entered under the next higher angle. Line IV, which gives the sums from the previous lines, thus indicates the increases in displacement for the various angles of inclination. In line V are entered the values for η from column VII, Table III, which are multiplied into the figures of the previous line, giving the desired correction n.

Table VI is used for assembly purposes. In the upper line are entered the values for P_0, G_0 and for $a_0 = g_0 - c_0$ (i. e., the distance between the center of gravity and the center of buoyancy). The total righting moment is $M - n - P_0a_0\sin\phi$, the value of which may be found for every tenth degree by means of this table.

It seems sufficient to add that in column I are entered the differences between the values for M and n for corresponding angles of inclination. In column II the same differences are given expressed in foot-tons, which values are obtained by dividing the figures in column I by 35. Column III gives the correction for the location of the center of gravity of the ship, which is expressed by $P_0a_0\sin\phi$. Column IV contains the differences between columns II and III, so that the figures in this column are the total righting moments. By dividing these moments by P_0 we obtain the corresponding lever arms, which are entered in column V, Table VI.

In order to obtain the corrections for loadings other than normal, Tables VII and VIII are made out. The total righting moment effective when the ship is loaded more deeply than to the normal load waterline is given by $M - n - P_0a\sin\phi + p(\eta - h\sin\phi)$, in which the last member is the correction for the excess load. In the formula p is the excess load in tons, η the figures from Column VII, Table III, h the distance of the center of gravity of the overloaded ship from the normal load waterline. The expression M-n is constant and may be figured once and for all, while the other members of the formula vary with the different locations of the

TABLE VI

$\varphi°$	$P_o = 3323$; $g_o = 13'.5$; $a_o = 3'.47$				
	I M − n	II $\frac{M-n}{\text{IN TONS}}$	III $P_o a_o \sin\varphi$	IV II − III	V IV ÷ P_o ARM IN FT.
10	120 880	3455	2000	1455	0.44
20	226180	6465	3945	2520	0.76
30	293 770	8390	5760	2630	0.79
40	336500	9615	7415	2200	0.66
50	367 700	10510	8830	1680	0.51
60	382 600	10930	9990	940	0.28

TABLE III

I $\varphi°$	II $\Sigma y_1 + \Sigma y_2$	III $\Sigma y_1^2 - \Sigma y_2^2$	IV $\Sigma y_1^3 + \Sigma y_2^3$	V AREA OF W.L. = II λ	VI STATIC MOMENTS OF W.L. = III × $\frac{1}{2}\lambda$	VII C.G. OF W.L. FROM INTERSECTION OF LWL. AND C.L. η = VI ÷ V	VIII $\frac{1}{2}$ VOLUME OF EMERGED WEDGE = V × $\frac{1}{2}\varphi$	IX MOM. OF INERTIA OF W.L. = I = IV × $\frac{1}{3}\lambda$ = m	X m = IX × φ
0	275.8	00	76590	7355	00	00	00	680600	118700
10	280.9	+ 91	80630	7495	+ 1210	+ 0.16	+ 106	716500	125000
20	253.3	− 1010	63472	6760	− 13480	− 1.99	− 1177	564000	98400
30	231.9	− 1969	60349	6180	− 26270	− 4.25	− 2292	536400	93600
40	227.6	− 2586	69135	6070	− 34500	− 5.69	− 3012	614000	107200
50	221.4	− 2737	69273	5905	− 36500	− 6.18	− 3188	615700	107400
60	211.1	− 2617	60773	5630	− 34900	− 6.20	− 3045	540000	94200

TABLE IV

MULTIPLY CROSSWISE ADD DIAGONALLY

MOMENT M

m_{60}	94200	47100						
m_{50}	107400	53700	105800					
m_{40}	107200	53600	105500	100700				
m_{30}	93600	46800	92200	87900	81000			
m_{20}	98400	49200	96900	92400	85200	75400		
m_{10}	125000	62500	123100	117500	108200	95700	80300	
$\frac{1}{2}m_0$	59350		58400	55800	51400	45500	38200	29700
cos φ		$\frac{1}{2}$	.985	.940	.866	.766	.643	.500
$\varphi°$		0	10	20	30	40	50	60
M		0	120900	228100	312600	391900	466200	520000

TABLE V — MOMENT n

	10°	20°	30°	40°	50°	60°
I VOL. FOR PRECEDING ANGLE OF INCLINATION	0	+ 106	− 965	− 4434	− 9738	− 15938
II TAB. III, COL. VIII, TRANSP.	0	+ 106	− 1177	− 2292	− 3012	− 3188
III " " " "	+ 106	− 1177	− 2292	− 3012	− 3188	− 3045
IV SUM OF LINES I, II and III	+ 106	− 965	− 4434	− 9738	− 15938	− 22171
V η	+ 0.16	− 1.99	4.25	− 5.69	− 6.18	− 6.20
VI n = IV × V	20.	1920.	18830	55400	98500	137400

$P_o = 3323$ tons
$C_o = 10'.03$
$H_o = 18'.5$
$p = P - P_o$
$a_o = g - C_o = 13.5 - 10.03 = 3.47$
$h = g - H_o$

center of gravity and with the different overloads, so that these members must be computed for the various conditions.

The quantities given in the first line in Tables VII and VIII are P_1, P_2=displacement for the overloaded ship, in tons; C_1, C_2=distance of center of buoyancy from keel, in feet; g_1, g_2=distance of center of gravity of ship from keel, in feet; p_1, p_2=the excess load, in tons; a_1, a_2=(g_1-c_1), (g_2-c_2); h_1, h_2=(g_1-H_0), (g_2-H_0).

The quantity n is positive when the center of gravity lies above the load waterline, i. e., when the ship is light; and negative when the center of gravity lies below the load waterline, i. e., when the ship is loaded.

S. S. New York News, Built by the North of Ireland Shipbuilding Company for the Ontario Paper Company, Is the Pioneer Ship of a Fleet of Special Steamers to Run on the Great Lakes. The Vessel Is 250 Feet Long Between Perpendiculars, 43 Feet Beam and 19 Feet 4 Inches Molded Depth, with a Speed of 10 Knots

Twin Vane-Wheel Propulsion of Ships

Model Experiments and Full-Size Ship Trials Show High Propulsive Efficiency Possible with Vane-Wheel Drive

PROPULSION by means of a screw, or screws, partially immersed has been experimented with at various times with small success, but recent experimental investigations with models by William Denny and Brothers, Ltd., Dumbarton, Scotland, have revealed the conditions that must be fulfilled in order to secure the advantages of this form of propulsion, and the model results have been confirmed by actual tests on a full-sized ship.

Partly immersed propelling wheels, such as side or stern paddles, are usually associated with vessels of such limited draft, in relation to speed and power, as to prohibit the application of screw propellers except at a great sacrifice of propulsive efficiency. It appears from the recent Denny experimental investigations with models, confirmed by a trial of a full-sized ship, that vane-wheels can not only advantageously replace other means of propulsion in such vessels, but may also be profitably applied to numerous cases where the draft is not so restricted, the limiting considerations being apparently, relative staunchness, or freedom from possible damage, if the vessel is to ply in rough seas. The suitability, or otherwise, of vane-wheels for rough seas has, however, yet to be proved and determined.

Vane-wheels, as manufactured by Messrs. Denny and Brothers, are partly immersed wheels having their axes above water and substantially in the line of advance. They are fitted with propelling vanes over the immersible circumferential portion, the vanes having a pitch so that when the wheels are rotated they exert a forward thrust on the vessel.

In order to avoid any undesired steering effect, it is necessary to have two vane-wheels of identical dimensions, and symmetrically placed in relation to the hull of the ship. The pitch of the vanes of one wheel is right-handed and of the other left-handed. They are rotated in opposite directions—preferably outward on top—so that the transverse thrust of each vane is balanced by that of the other when they are driven at the same revolutions per minute; also the steering effect of each forward thrust moment is equal and opposite.

The dimensions, pitch and area of the vanes must be designed to suit the speed, revolutions per minute and power. The vane-wheels may be placed side by side abaft the stern of the ship, or they may be placed one on each side of the ship at any point forward of the stern.

The advantages of the twin vane-wheel method of propulsion are as follows:

A. High propulsive efficiency in relation to all other known methods of propulsion.
B. Great maneuvering powers.
C. Effective variation of water acted upon with variation of draft, and therefore of variation of the thrust required.
D. Higher revolutions per minute than either side paddle wheels or stern paddle wheels, and therefore less weight of machinery.
E. With vane-wheels abaft the stern of the ship the overall width is less than that with side paddle wheel method; there is also less overall length of ship and wheels than in the stern paddle wheel method.
F. The wheels are stronger and lighter than either side paddle wheels or stern paddle wheels.

With regard to the advantage *A* it appears that vane-wheels are so very efficient as to warrant their adoption in many cases of vessels of deep draft. Without referring to the results of numerous experiments with models of vane-wheels applied to models of ships, it will be sufficient for present purposes to give the actual results obtained from measured mile trials of a twin-screw ship, which was first tried with her twin screws, and afterwards with vane-wheels

Denny Brothers' Experimental Vessel Fitted With Vane-Wheels for Its Propulsion

Stern View of Vane-Wheel Propelled Vessel Under Way, Showing Wake

driven by leather belting from the main engines (a temporary arrangement). The particulars of the vessel, and results obtained, are as follows:

Length	100 feet
Breadth	23.5 feet
Draft, forward	4 feet 5½ inches
Draft, aft	4 feet 8 inches
Draft, mean	4 feet 6¾ inches
Displacement	186 tons
Speed	9 knots

	Screw Propellers	Vane Wheels
Diameter	4 feet	11 feet
Pitch	5 feet 8 inches	16 feet
Number of blades	3	3
Total disk area	25.14 square feet	....
Total projected area	10.2 square feet	....
Immersion of tips in still water	3 7/16 inches	....
Revolutions per minute	226	66
Total sectional area of water acted upon when at full speed	....	59.26 square feet
Effective horsepower of naked hull	77.5	77.5
Shaft horsepower	197	116

It will be seen that the vane-wheels gave the same speed as the twin screws with 41 percent less shaft horsepower.

Experimental Vessel Driven by Twin Vane-Wheels at Nine Knots

This was confirmed by the measured difference in oil consumption allowing for the loss due to the belt drive.

It will also be seen that the propulsive efficiency of the twin screws was rather low, though the resistance of the shaft brackets and projections (in this case amounting to 12 percent of the effective horsepower of the naked hull), together with the effect of the small immersion of the tips of the propellers, would probably not permit of a much higher efficiency being obtained.

In evolving a new design for a vane-wheel vessel several alternatives are available. If the speed is fixed, then the vane-wheels will require considerably less power than twin screws for the same dimensions and form of ship and this will permit of either increased deadweight, or, by the adoption of finer lines for the vessel, a still further reduction of power for the same speed. If it be preferred to obtain a higher speed than twin screws will give for the same dimensions and form, then the increase of speed depends on the relation of increase of power to increase of speed, but it will, in any case, be a considerable amount.

Advantage *B* must be seen to be fully appreciated, but a vane-wheel vessel can be made to turn very rapidly about its own axis without advancing.

Advantage *C* is somewhat unique, for, although side paddle wheels and stern paddle wheels seem to possess the same advantage, yet for understandable reasons it is well known that their propulsive efficiencies become considerably reduced with both over immersion and under immersion, i.e., the design does not permit of much variation of draft of ship. In the case of vane-wheels every portion of the immersed vanes is applied effectively at all drafts. The vane-wheels permit of considerable variation of immersion, so that at the deeper drafts they have the advantage of acting efficiently on a greater sectional area of water, and thus the revolutions per minute and slip, for the same speed, are not so variable in terms of draft variation as is the case with the other available methods of propulsion.

At the lighter drafts of a vessel which is run at considerable variations of draft the percentage reduction in the sectional area of the water acted upon is greater than the percentage reduction of thrust, so that, if the pitch of the vane-wheels be uniform, the revolutions per minute and slip will be greater than for the deeper drafts.

It is proposed to make experimental investigation to ascertain if further advantage can be secured by gradually increasing the pitch of the vanes towards the extreme diameter, with a view to securing even less variation of revolutions per minute with varying draft and the same speed.

An explanation of the causes of the high propulsive efficiency of the vane-wheels may be found in the following facts:

The hubs of the vane-wheels are out of the water and therefore involve no extra resistance as in the case of ordinary screw propellers. Vane-wheels do not require any immersed supports as in the case of twin screws, e.g., bosses or brackets. Every portion of the immersed vane is acting efficiently during its passage through the water, being superior to paddle floats in that respect. Vane-wheels can be, and are, more favorably placed in relation to the flow of water around the hull than is the case with ordinary screw propellers or with stern paddle wheels.

Pneumatic Tools

TWO new developments in pneumatic tools made by the King Pneumatic Tool Company, Chicago, are a sleeve-type valve for riveting hammers and a "Progressive" lock for both chipping and riveting hammers which prevents the handles from coming loose on the cylinders.

The King sleeve valve for riveting hammers is designed to eliminate valve breakage and reduce the necessity of oversizing valves to a minimum. In the King riveting hammer valve the hard and fast hitting qualities of the hollow-valve type riveting hammer are maintained and the question of valve breakage is claimed to be solved. Formerly a riveting hammer piston in hollow-valve type hammers came in direct contact with the valve; the piston and the valve moved in opposite directions and the piston came in direct contact with the valve 1,050 to 1,720 times per minute, according to the length of stroke of the hammer. This constant contact between piston and valve resulted in fatigue of the metal in the valve itself, with resulting valve breakage.

In the King sleeve-type valve the sleeve is interposed between the valve and the piston, making any contract between the two impossible. At the same time the sleeve provides a continuous bearing surface for the piston. An added advantage of the sleeve-type valve is that the sleeve serves as a guide to the valve in its travel, thus reducing the lateral wear to a minimum. This new device has been so successful in eliminating valve breakage that last year, out of 5,000 King sleeve valves placed in service, only 15 cases of breakage were reported.

King pneumatic tools are now made entirely of molybdenum steel, which has added to their strength and durability.

A Double Acting Marine Diesel Engine

Satisfactory Tests on 240 Horsepower Unit Causes Rapid Construction of Three-Cylinder, Two-Cycle 2,000 Brake Horsepower Engine

THE North British Diesel Engine Works has evolved a double acting Diesel engine having three cylinders of small dimensions and working on the two-cycle principle. Thus another type of marine engine is added to the long list. The job of the marine engineer of thirty years ago, with his reciprocating steam engine, looks like a sinecure today in comparison with the study and work that must now be put in just to keep up to date with the various developments.

A long struggle for supremacy is bound to occur between the turbine with its mechanical reduction gears, the turbine with the electric drive, the Diesel engine with the direct drive, reduction gears both mechanical and electrical, single, compound, two-cycle, four-cycle and double acting, to say nothing of such variations as opposed pistons and combinations of steam and oil fuel.

Competition will be keen and for this reason the double acting oil engine offers theoretical possibilities in the reduction of weight and space and in simplicity that the development of this type of engine is bound to be watched with interest. The shipowner of course wants the type of engine that will reduce his operating costs to a minimum but above all he demands regularity and reliability of performance.

The engine illustrated by Figs. 1 and 4 was built and thoroughly tested by the North British Diesel Engine Works. It has two working cylinders of $11\frac{1}{2}$ inches bore and $14\frac{1}{2}$ inches stroke. At 250 revolutions per minute it develops 240 brake horsepower. This engine is said to be very carefully balanced and it is claimed that with a combination of anywhere from 3 to 8 cylinders a balance can be obtained that will compare with that of a four-cylinder triple or quadruple expansion steam engine.

Principle of Operation

The diagram shown in Fig. 4 illustrates the principle upon which the engine operates, although some changes and improvements have been embodied in the 2,000 brake horsepower engine that is now under construction.

The engine consists of an open ended cylinder *A*, made in two parts and flanged for bolt connections in the middle. The water jacket *B*, together with the scavenge and exhaust pipes *C*, C_1, *D*, D_1, are free to reciprocate using the top and bottom cylinder covers *E*, E_1 as guides. The cylinder covers are stationary being fitted with gas tight rings of the piston type. Each cover is fitted with a fuel and starting air valves.

Piston and Connecting Rods

The trunk type piston *F* is fitted with a gudgeon pin *G*, which projects through the axial slots *V* in the cylinder *A*. The crosshead slippers *K*, K_1 are fastened, one at each end of the gudgeon pin. Bearings *H*, H_1 are provided on the parts of the crosshead slippers which are attached to the ends of the gudgeon pin *G* to take the connecting rod top end bushes *J*, J_1. The connecting rods *L*, L_1 run between the cross-

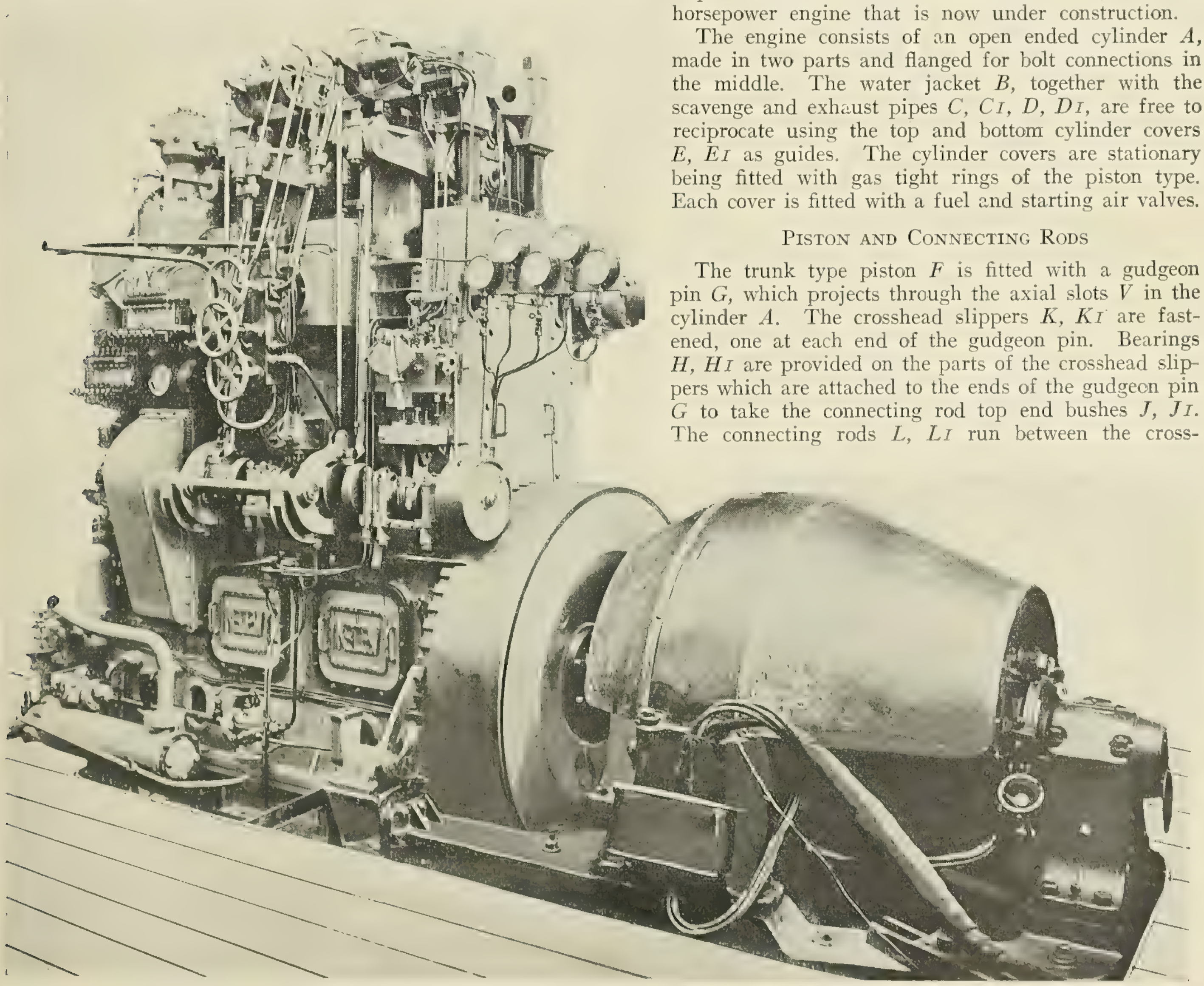


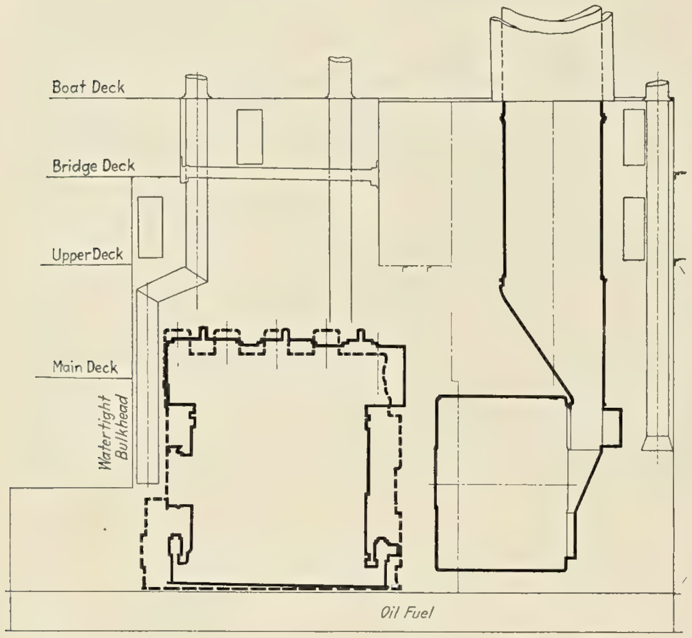
Fig. 1.—The New North British Double Acting Two Cycle Marine Diesel Engine

head bearings and the forked end M. The lower end of the forked end M is connected to the crank pin by the bearing N. The crank is designated by the letter P and the shaft bearings by Q, $Q1$.

Cylinder Operation

The special feature of this engine is the moving cylinder which reciprocates synchronously with the piston but through a much smaller distance. The cylinder A, the water jacket B, scavenge pipes C, C_1 and exhaust pipes D, $D1$ are made to reciprocate through the action of a cam shaft driving the cranks and connecting rods S, T, U, Z. The crank Z on the cam shaft drives the rod S, which is connected at the top to the beam levers T, which are pivoted at W. U and $U1$ are links which are attached at their top ends to trunnions fitted to the cylinder and at their lower ends to the levers T, $T1$.

It is to be noted that the cylinder A and its water jacket B travel in the same direction as the piston but at a lower speed. Scavenging ports C_2, C_3, which are supplied by the scavenge air pipes C, C_1, are uncovered by the relative movement of the cylinder A to the cylinder covers E, $E1$.



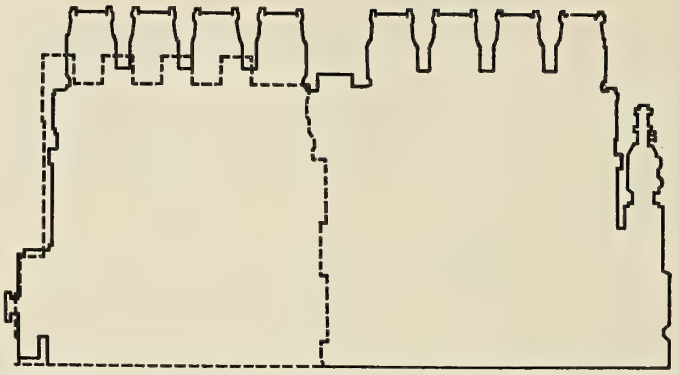


Fig. 3.—Comparison Between Double Acting Diesel Engine (dotted lines) and Four Cycle Diesel (solid lines) of 2,000 Indicated Horsepower

In like manner the relative movements of the piston and cylinder uncover the exhaust ports $D2$, $D3$, through which the exhaust gases pass to pipes D, $D1$. A supercharge of scavenging air is obtained by opening and closing the exhaust ports before the scavenging ports but this has not been found to be essential and will not be embodied in the new engine.

Stuffing boxes are provided in the fixed scavenge supply pipe X for each of the reciprocating scavenge branches and also in the fixed exhaust manifold Y for the moving exhaust branches. In this engine the branches are uncooled but water-cooling is contemplated for the larger engines.

Cylinder Covers

The cylinder covers E, $E1$ are fixed to the main structure. Fuel valves in both top and bottom covers are operated by cams. Both fuel pumps and air starting distributing valves are also driven from the cam shaft. A horizontal lubricating oil pump and a circulating water pump are driven at the end of the crank shaft remote from the fly wheel. The scavenging air pump and a three-stage air compressor are driven from a common crank with forked links.

Advantages Claimed

As is well known, cylinder expansion is one of the hardest things to take care of in big engines. In this engine the cylinder is free to expand longitudinally and radially and in

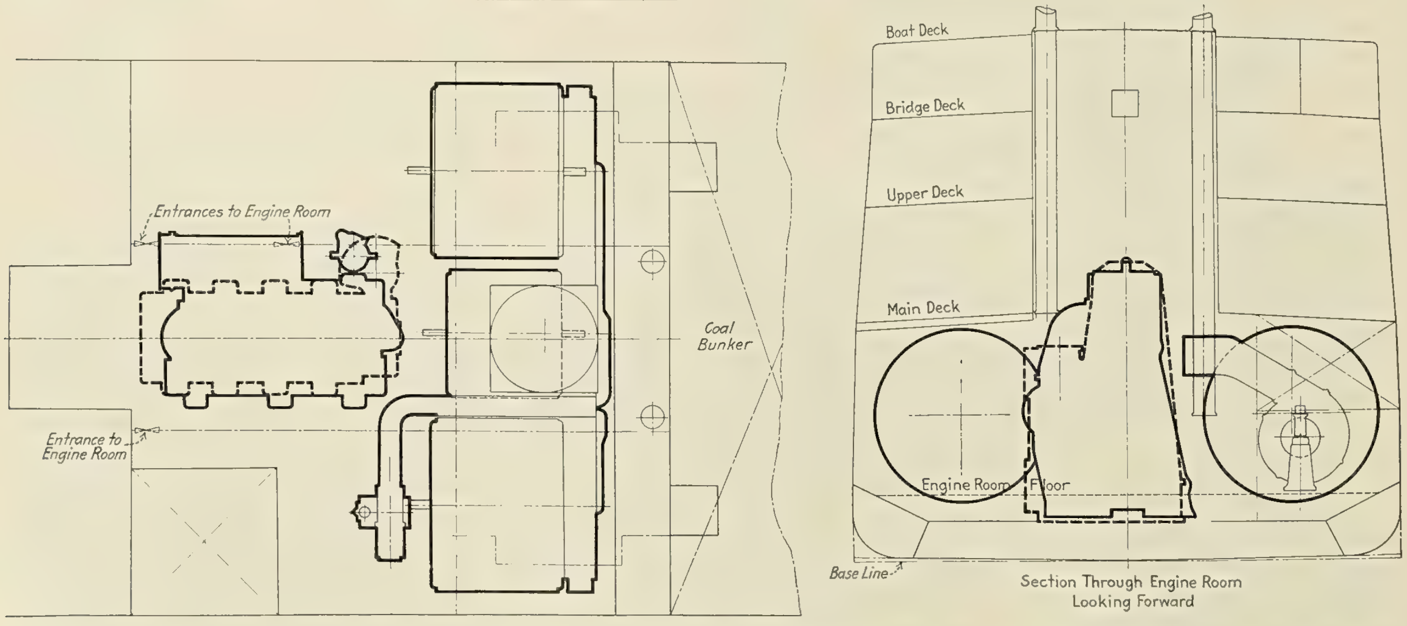


Fig. 2.—Comparison Between Double Acting Diesel Installation (heavy dotted lines) and Corresponding Steam Reciprocating Installation (heavy solid black lines) of 2,000 Indicated Horsepower

the way of combustion space it takes the form of a plain cylinder entirely surrounded by water. It is also to be noted that, due to the motion of the cylinder itself, the rubbing speed of the piston is reduced about 30 percent. The arrangement of scavenging and exhaust ports being at opposite ends of the working cylinder is exceptionally good as through scavenge is obtained and it also does away with certain heat stresses. Another point is that the cylinder covers may be removed without breaking any high pressure cylinder joints.

3-Cylinder, 2,000-B.H.P. Engine

The trials of the engine just described were so satisfactory that the North British Diesel Engine Works has proceeded to construct a 2,000 brake horsepower engine on the two-cycle principle. The engine will have three cylinders with a 24½-inch bore and a stroke of 44 inches. It will run at 100 revolutions per minute. Many improvements in mechanical detail are included in the new design and it is claimed that a remarkable simplicity of construction is obtained in spite of the necessity for providing mechanism for reciprocating the cylinders.

Space Comparisons

The saving in space, which is accomplished by an engine of 2,000 horsepower of this type, as compared with a corresponding steam engine and also with a four cycle single acting Diesel is illustrated in Figs 2 and 3. The four cycle engine, shown in Fig. 3, was installed in the motor passenger liner *Domala* and was also manufactured by the North British Diesel Engine Works. The steam installation shown in Fig. 2 is a single screw steam reciprocating engine of 2,000 indicated horsepower.

The double acting Diesel engine is shown in both cases as a four-cylinder engine having a cylinder bore of 22 inches as compared with 26½ inches in the eight-cylinder four-cycle single acting engine and it is claimed that it weighs just one-half as much. Only half of the main bearings, crosshead bearings and guide shoes are required and only 8 cylinder valves are required as compared with 24 in the four-cycle engine. They both have the same number of revolutions per minute but the four-cycle engine has a piston speed 88 percent greater than that of the sliding cylinder double acting engine.

As compared with the steam engine, it is seen that the double acting engine only takes up the space of the reciprocating steam engine leaving the boiler and bunker space available for extra cargo. With such possible advantages, there is no doubt that the developments in this type of engine will be watched with extreme interest.

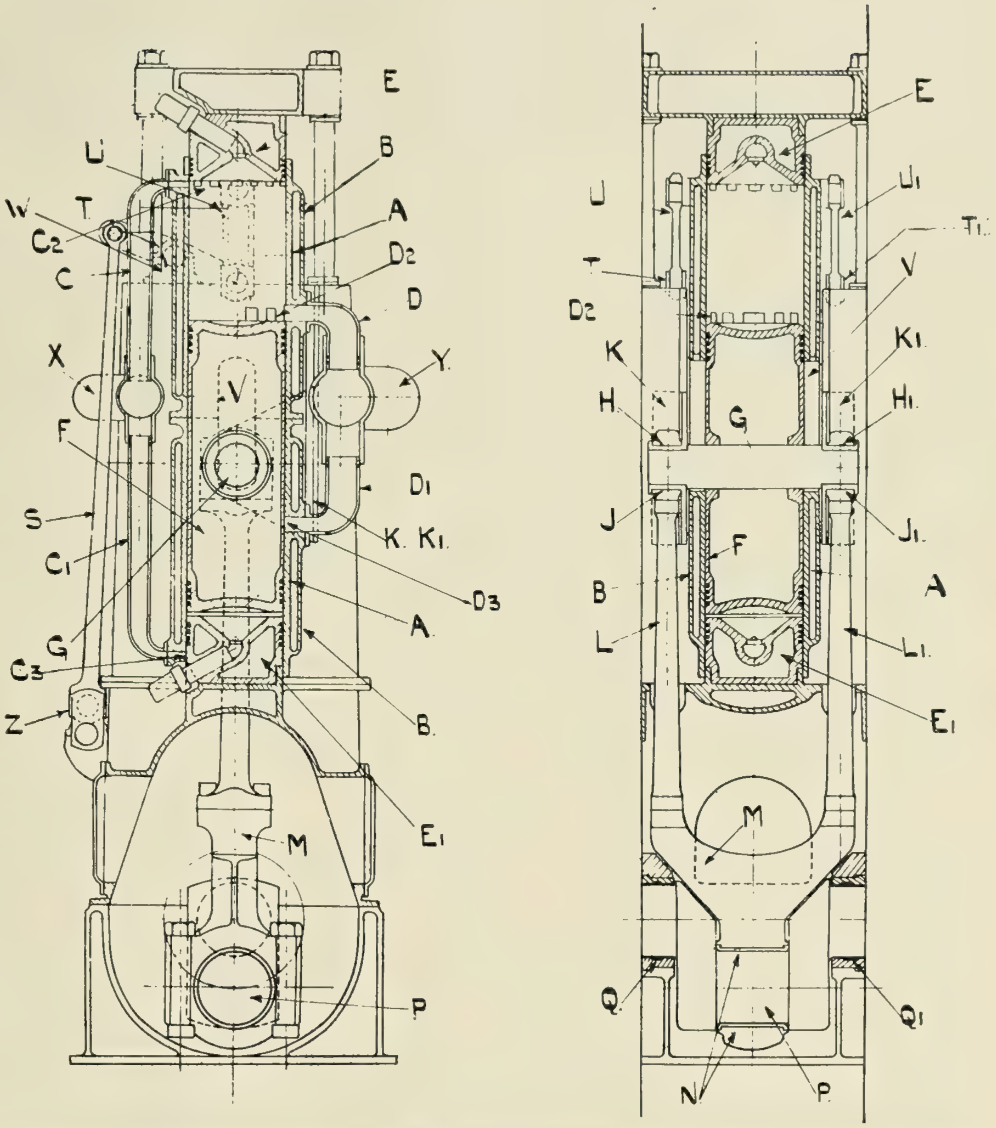


Fig. 4—Diagrammatic Sketch Showing Construction and Operation of New North British Double Acting Diesel Engine

---

Electrically Propelled Battleships Win Honors.—Chief honor for excellence in engineering for the year 1921-22 has been awarded the U. S. S. *California*, third of Uncle Sam's electric ships, by Acting Secretary of the Navy Roosevelt. Second honors were awarded the U. S. S. *New Mexico*, the first electrically propelled battleship to float on the seas. The equipment of this vessel is several years old.

Eighteen battleships were considered in making the awards. So that all ships might start the year on as near an equal standing as possible, handicaps were allowed the vessels of older type and with other kinds of propelling apparatus.

In recognition of these high honors, the *California* will have a white "E" painted on her smokepipe, and the *New Mexico* will have a red "E" on her after smokepipe. The *New Mexico* has carried the white "E" for the past year, having won the highest honors in engineering for the year 1920-21. She now passes this honor to the *California*, which was commissioned and entered in the competition about one year ago. Both ships were electrically equipped by the General Electric Company.

The enlisted men of the engineering force on the *California* will each be awarded a prize of $10 by the government, and a letter of commendation, signed by the Secretary of the Navy, will be sent Rear Admiral Henry J. Zeigemeier, commander of the ship. Admiral E. W. Eberle, commander-in-chief of the Pacific fleet, warmly congratulated the officers and men of the *California* on these well earned honors.

A Method of Determining the Natural Periods of Vibration of Ships*

By T. C. Tobin, M. A.

So far as the writer is aware no direct method of attacking this problem has been put forward which is at once adequate and of comparatively easy application along the lines of ordinary drawing office procedure.

The usual method of estimating the fundamental periodicities of a ship's vibration by means of a formula of the character

$$P = A\sqrt{\frac{I}{\Delta L^3}}$$

in which A is an empirical coefficient, leaves much to be desired; for the burden of accuracy in the estimate is borne entirely by coefficient A, which as a rule receives the treatment accorded to so many other empirical constants in naval architecture.

The method of direct attack suggested in what follows is based on the theory of vibrating bars made familiar by the work of the late Lord Rayleigh. For this purpose a ship is conceived as corresponding to a bar in lateral vibration, and it is evident of course that the variation in the distribution of the weight throughout the length of the vessel, as well as the variation of the ship's structure, prevent it from being considered as a uniform bar.

In the usual formula just quoted these variations meet in the one constant A; and the success of the ordinary procedure depends on a knowledge of the fundamental periods of some ship which is sufficiently similar to the one under consideration to ensure that the errors due to differences of weight and strength distribution are negligible. The necessary condition holds in very few cases, and the formula affords no means of estimating the periods for any novel distribution. In the procedure to be outlined the variations are dealt with on their own merits.

Were the ship a uniform bar the frequency of its periods would be given by:

$$P = \frac{n^2}{2\pi}\sqrt{\frac{E\,I\,g}{\Delta L^3}}$$

where E is Young's modulus for the material of the structure; I the moment of inertia of the cross section of the bar; Δ the weight in tons; L the length in feet; g the gravitational constant; and n a numerical magnitude depending on the mode of vibration.

When the mass and rigidity vary along the length of the bar, the frequency is modified to p where

$$p = P\sqrt{\frac{1 + \delta c/c}{1 + \delta a/a}} \quad \text{..............................(See Appendix I)}$$

This may be taken to be true to a close approximation, so long as the type of vibration remains approximately normal.

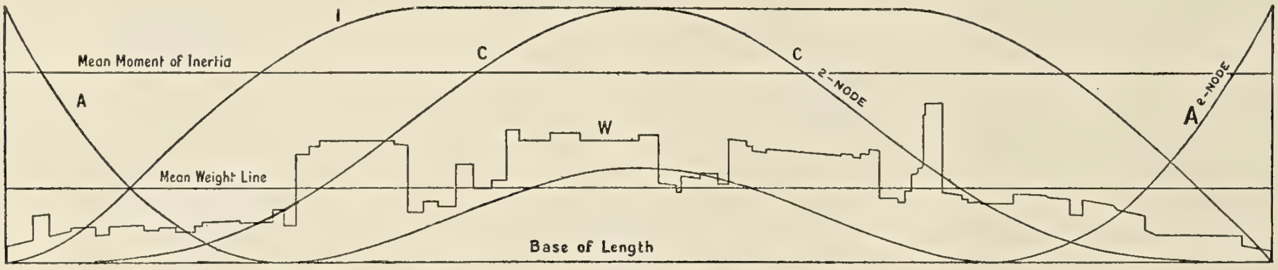


Fig. 1

This modification was originally devised to meet the case of small variations of mass and flexural rigidity, and it does not necessarily follow that the method would give close results, when the variations are somewhat large. It appeared, however, to the writer that for a large body, such as a ship, there was a possibility of the vibrations not departing from the normal to any great extent, and that the application of this formula would give a determination of the periods which would be useful for estimating purposes.

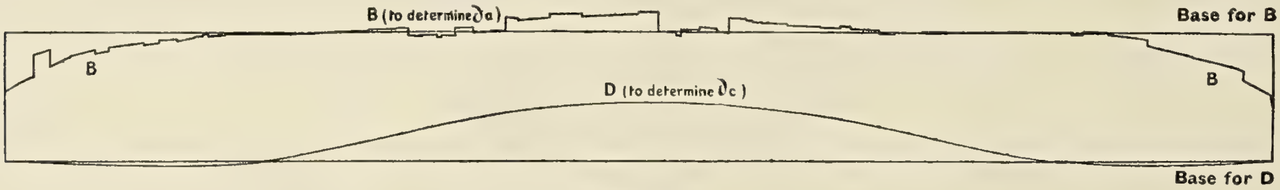


Fig. 2

The quantities a, δa, c, δc, are determined as follows: The weight distribution curve W, Fig. 1, is plotted for the vessel, and the mean weight line drawn; the auxiliary curve A is also drawn covering the same range as the weight curve;

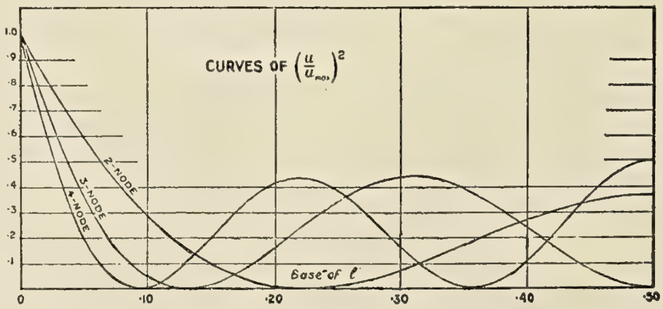


Fig. 3

*Paper read at the sixty-third session of the Institution of Naval Architects, London, April, 1922.

the difference of the ordinates of the weight curve and the mean weight line at any given point in the length is multiplied by the ordinate of the auxiliary curve A at that point and the series of products thus obtained plotted as a curve over the whole range, as B, Fig. 2. The area of the B curve is integrated by any convenient method, mechanical or otherwise, and this integral is the quantity δa; the integral of the auxiliary curve A multiplied by the integral of the weight curve, both taken over the range of length, gives the quantity a; hence dividing one by the other we obtain $\frac{\delta a}{a}$.

In a similar manner $\frac{\delta c}{c}$ is obtained, by using, instead of the weight curve, a curve giving the distribution of the moment of inertia (I) throughout the length, and another appropriate auxiliary curve C, to obtain the curve D in Fig. 2.

The ship may be compared to a bar which has both ends unconstrained, or in the Rayleigh nomenclature a "free-free" bar. Such a bar may of course vibrate in a two-node, three-node, four-node, . . . r-node manner.

For each mode of vibration a particular auxiliary curve for each of the δa and δc determinations is required; those associated with the δa for the two-, three- and four-node vibrations are shown in Fig. 3, and those associated with δc in Fig. 4.

As a test of the utility of the methods it was applied to two ships of widely differing types.

The first case was that of an oil tanker, particulars of which were published in the *Transactions of the Society of Naval Architects and Marine Engineers* in 1915.* Investigations carried out on this vessel showed that the fundamental period had a frequency of 76 vibrations per minute; while calculations carried out on the lines which have been indicated gave the frequency of the two-node vibrations as 75.4 per minute, on the assumption that Young's modulus had the value 12,500 inch-ton units.

The second case was that of a large passenger liner. An extensive series of records made with a Schlick pallograph showed that under certain observed conditions of loading two clearly defined periods of vibration were observable which appeared to correspond to fundamental periods of the ship, and these had frequencies of 58.8 and 150 per minute.

The calculation for a two-node vibration carried out by the proposed method gave 59.4 as the corresponding number of vibrations per minute; the three-node calculation resulting in the figure 148.7; the value of Young's modulus E again being assumed to be 12,500.

In arriving at these figures a correction was made for the rotatory inertia effect in the manner suggested in Appendix II. For the two-node vibration it was of the order of 2½ percent, and for the three-node about 3¾ percent. The as indicated in Appendix III., and found to be quite neg- effect of the varying local displacement was also estimated

*"The Period of Vibration of a Steamship," by W. Gatewood.

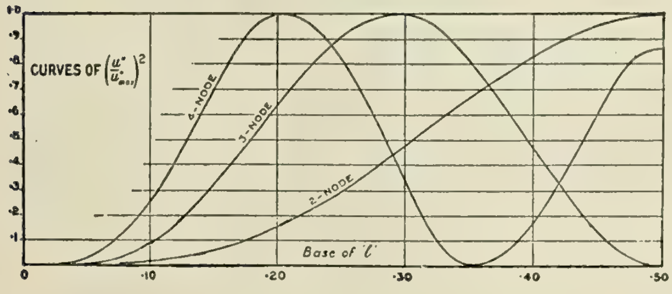


Fig. 4

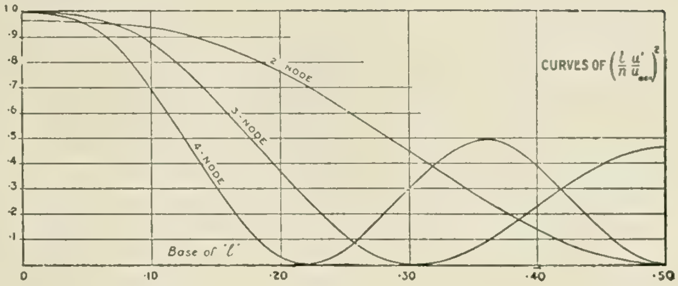


Fig. 5

ligible as might have been expected; the mean value of F in this case was about 2.6 tons.

Had second order terms expressing the interaction of modified two-node and three-node types of vibration been taken into account it would have resulted in a slight shortening of the three-node period and a slight lengthening of the two-node; this would have probably brought the ratio of the two periods more nearly into correspondence with the observed values. As it is, the correspondence is close enough to suggest that the method may prove a reliable one for investigating the values of the two gravest modes of vibration.

It is interesting to note that the same value of E fits the solution in both cases; and this is the only quantity whose value is directly assumed. From the opposite point of view it may be regarded as in some sense a corroboration that this value of E is an approximately correct one to use with ship structures of this type, when the values of I are estimated in the usual manner.

A calculation of the four-node vibration of the liner was also made, giving as a result a frequency of 269 per minute; the observed vibrations of the vessel gave, however, no decisive indications for this third fundamental mode of vibration. The value of the rotatory inertia correction in this case was of the order of 7½ percent.

It would be extremely interesting to have additional verification that the method gives results in harmony with observed vibrations of ships; unfortunately the time at the author's disposal did not permit him further to test its validity, but it is hoped that what has been said will be sufficient to indicate that the procedure merits the attention of those who may have to deal with concrete cases of vibration.

Appendix I

If the type of vibration of a "free-free" bar is considered as a deviation from the normal we may proceed as follows: The expressions for the kinetic energy, T, and the potential energy, V, for a uniform bar may be written in the general form:

$$2T = a\,\phi^2$$
$$2V = c\,\phi^2$$

where ϕ is the normal coordinate corresponding to the type of vibration, and a and c are the mechanical functions.

If now the mass of the bar is altered in its longitudinal distribution, and the moment of inertia is also varied, these expressions become

$$2T' = (a + \delta a)\,\phi^2$$
$$2V' = (c + \delta c)\,\phi^2$$

on the assumption that the type of vibration is not materially altered.

If P is the frequency for the uniform bar, and p that for the modified bar, we then have

$$P = \sqrt{\frac{c}{a}};\quad p = \sqrt{\frac{c + \delta c}{a + \delta a}}$$

$$\text{i.e., } p = P\sqrt{\frac{1 + \delta c/c}{1 + \delta a/a}}$$

so long as the type remains approximately normal.

In the case of a doubly free bar we have the type:

$$y = A\,u\cos\left(\sqrt{\frac{EI}{m}}\cdot\frac{n^2}{l^2}\cdot t + \epsilon\right) = A\,u\,\phi$$

where u is the normal function satisfying the equation:

$$\frac{d^4 u}{dx^4} = \frac{n^4}{l^4}\,u$$

A being an arbitrary constant; E, Young's modulus; m the mass per unit length; I the moment of inertia of the section, and l the length of the bar. We have also:

$$a = m\int_0^l u^2\,dx \quad\text{and}$$
$$c = EI\int_0^l u''^2\,dx \quad\text{for the uniform bar}$$

and hence the variational values:

$$\left.\begin{aligned}\delta a &= \int_0^l \delta m \,.\, u^2\, dx \\ \delta c &= \mathrm{E}\int_0^l \delta \mathrm{I} \,.\, u''^2\, dx\end{aligned}\right\}\text{for the modified bar}$$

where $u' = \dfrac{du}{dx}$; and $u'' = \dfrac{d^2u}{dx^2}$

It would be possible, of course, to find

$$\int_0^l m\, u^2\, dx \text{ and } \mathrm{E}\int_0^l I\, u''^2\, dx$$

and the periodicity derived from this giving

$$p = \sqrt{\frac{\mathrm{E}\int_0^l \mathrm{I}\, u''^2\, dx}{\int_0^l m\, u^2 dx}}$$

but as u and u'' apply strictly speaking only to a uniform bar, and not to the bar with varying I and m, it is considered a sounder method of procedure to calculate as indicated above by δa and δc.

Auxiliary curves giving the variation of the values of u^2 and u''^2 over the range of length are required, and these were calculated from the differential equation given above together with the associated equation:

$$\cos n \cosh n = 1$$

The values expressed as ratios of the maximum value in each case are shown in Figs. 3 and 4 in the form of curves, and the numerical values are given in Appendix IV.

The values of n for the two-, three- and four-node vibration are, respectively, 4.7300, 7.8532, 10.9956.

Appendix II

To estimate the effect on the period due to the rotatory inertia we may use a modified expression for the kinetic energy, viz.:

$$2\,\mathrm{T} = \int_0^l m\, y^2\, dx + \int_0^l \mathrm{I} \left(\frac{d}{dt} \,.\, \frac{dy}{dx}\right)^2 dx$$

$$= p^2 \,.\, \sin^2 p\, t \left[\int_0^l m\, u^2\, dx + \frac{n^2}{l^2}\int_0^l \mathrm{I}\left(\frac{l\, u'}{n}\right)^2 . \, dx\right]$$

where $y = u \cos p\, t$,
$\dot{y} = -u\, p \,.\, \sin p\, t$,
$m =$ mass per unit length of curve of loads,
$\mathrm{I} =$ mass moment of inertia per unit length.

Curves of I, u^2 and u''^2 are wanted, the two latter in terms of the same units. I refers to the mass of material which has rotatory inertia, excluding the masses not rigidly attached to the ship; it will not therefore involve as a rule the total mass of the vessel.

For estimating purposes and to simplify the calculations it was assumed that the masses not rigidly attached to the structure were distributed uniformly over the depth of the section at each point; their moments of inertia then became equal to $\dfrac{m\, d^2}{12}$ where d is the depth of the section taken as uniform throughout the length and equal to the molded depth plus one-third of the mean sheer.

This assumption tends to increase the value of the correction, that is, to over-estimate it rather than under-estimate it. Curves of $\left(\dfrac{l\, u'}{n}\right)^2$ are given in Fig. 5 for the same unitary value as the corresponding curves of u^2 in Fig. 3; the quantity $\left(\dfrac{l\, u'}{n}\right)$ being used in preference to u as being more readily comparable with u. The numerical values are given in Appendix IV.

The frequency is then altered in the ratio:

$$\left[1 + \frac{\dfrac{n^2}{l^2}\displaystyle\int_0^l \mathrm{I}\left(\frac{l\, u'}{n}\right)^2 . \, dx}{\displaystyle\int_0^l m\, u^2\, dx}\right]^{-\frac{1}{2}}$$

Appendix III

An estimate can be made of the effect on the period resulting from the varying local displacement due to the motion, by suitably modifying the expression for the potential energy.

If it is assumed that for a large portion of the length the vessel is wall-sided in the neighborhood of the waterline, the increase and decrease of buoyancy force will be, to a first approximation, proportional to the ordinate of the normal function.

This will have the effect of adding a term to the V function of the form $\frac{1}{2}\,\mathrm{F}\, u^2$, where F is the force called into play per unit length. We have, therefore:

$$2\,\mathrm{V} = \int_0^l \mathrm{E}\,\mathrm{I}\, u''^2 \,.\, dx + \int_0^l \mathrm{F}\, u^2\, dx$$

The calculation may be simplified and the order of the correction discovered by assuming F constant throughout the length and equal to an estimated mean value.

Appendix IV

Values of $\left(\dfrac{u}{u \text{ max.}}\right)^2$

$x/l =$	0	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
2-node	1.0000	.5900	.2890	.0980	.0095	.0098	.0740	.1716	.2710	.3435	.3700
3-node	1.0000	.3697	.0517	.0138	.1579	.3422	.4383	.3900	.2333	.0690	....
4-node	1.0000	.2058	.0031	.1950	.4132	.3858	.1575	.0020	.1075	.3613	.5056

Values of $\left(\dfrac{u''}{u'' \text{ max.}}\right)^2$

$x/l =$	0	0.5	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
2-node	....	.0010	.0142	.0593	.1521	.2953	.4761	.6685	.8397	.9576	1.0000
3-node	....	.0079	.0912	.3162	.6393	.9164	.9950	.8180	.4697	.1364	....
4-node	....	.0267	.2554	.7060	.9990	.8253	.3316	.0078	.1735	.6153	.8687

Values of $\left(\dfrac{l}{n} \,.\, \dfrac{u'}{u \text{ max.}}\right)^2$

$x/l =$	0	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
2-node	.9654	.9611	.9350	.8712	.7640	.6184	.4494	.2792	.1333	.0348	....
3-node	1.0000	.9818	.8751	.6525	.3658	.1170	.0024	.1190	.2246	.3995	.4725
4-node	1.0000	.9527	.6975	.3084	.0275	.0570	.3067	.4825	.3901	.1348	....

Twin Screw Passenger and Cargo Steamer Diogenes Built by Harland and Wolff, Ltd., for the Australian Service of the Aberdeen Line: Length, 500 Feet; Beam, 63 Feet; Depth, 35 Feet 3 Inches; Gross Tonnage, 12,300; First Class Passengers, 132; Third Class Passengers, 422; Propelling Machinery, Brown-Curtis Compound Turbines

Fig. 1.—A Wall of Water From Six Nozzles on New York City Fireboat Thomas Willett

Testing the New Pumping Equipment of the New York City Fireboat Thomas Willett

On July 17, tests were made of the new pumping equipment that has been installed on the veteran New York City fireboat *Thomas Willett.* This equipment consists of two 600 brake horsepower Westinghouse steam turbines, of the mechanical drive type, each of which is direct-connected to a 12-inch Lea-Courtney double-suction, volute fire pump.

The average performance of the pumps during the test, which lasted 6 hours, was 9,215 gallons per minute at 150 pounds pressure and 7,410 gallons per minute at 175 pounds pressure, when operated singly, and 4,690 gallons per minute at 300 pounds pressure when connected in series and operated together. In all tests, the Underwriters' requirements were greatly exceeded. The steam pressure was 185 pounds per square inch at the turbine and the suction head 4 pounds per square inch.

The equipment was purchased for the City of New York by Fire Commissioner Thomas J. Drennan. Similar equipment has been ordered to replace the present pumps in the *James Duane,* another fireboat.

Fig. 2.—High Pressure Test

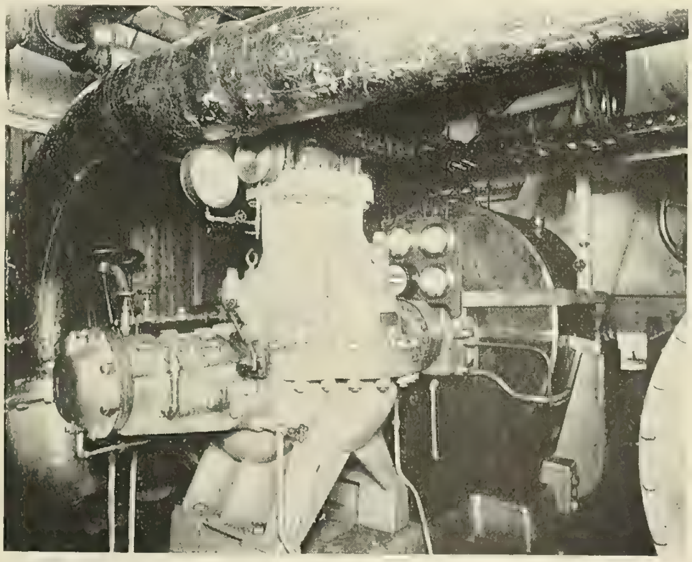


Fig. 3.—600 Horsepower Westinghouse Turbine Driving 12-Inch Lea-Courtney Fire Pump

United States Navy's Research of Ship Bottom Paint

By N. E. Adamson*

Second and concluding installment of an article prepared from the author's notes on research pertaining to ship bottom paints during the past 12 years, augumented by data drawn from the files at the Norfolk Navy Yard, where most of the Navy's research on this subject has taken place. Because of the great volume of data, a brief description of the tests and the history of the research is given rather than a technical discussion of the subject. For obvious reasons the trade names of proprietary paints and materials are omitted. This article was originally read before a committee of the Society for Testing Materials.

FROM 1911 to 1921 was a period of testing various ingredients in bottom paint formulæ designed after the Norfolk formulæ 17 and 19. These tests included approximately 350 preliminary investigations made by submerging steel plates as well as a great number of service tests on ship bottoms, all of these tests being conducted under the writer's observation. In order to follow the data it is well here to insert the formulæ for Norfolk ship bottom paints used at the beginning of this period. They were:

Ingredients	For 100 gallons Anti-corrosive	Anti-fouling
Grain alcohol	74¾ gallons	64 gallons
Gum shellac, Grade A	79½ pounds	137½ pounds
Turpentine	6⅜ gallons	10½ gallons
Pine tar oil	6⅜ gallons	10½ gallons
Zinc oxide, dry	284½ pounds	137½ pounds
Zinc dust	95 pounds	00
Indian red, dry	00	137½ pounds
Red mecuric oxide	00	47½ pounds

An outline of the tests pertaining to each ingredient is as follows:

Testing Ingredients in the Ship Bottom Paints

Since 94 percent pure grain alcohol is obtainable without the payment of internal revenue, it has not been necessary to consider wood alcohol for the sake of cost. The present rate is $0.35 per gallon. However, to prevent tampering with the paint to extract the alcohol for beverage purposes, the alcohol is now denatured by adding a very small percentage of croton oil and a red dye (fuchsin). So far as has been observed this has not affected the properties of the paints.

Gum shellac, a material obtained from India, was once used extensively in commercial ship bottom paints but due to the manner in which it is produced, it being an excretion from certain species of insects, the supply is limited. In 1911 the Navy Department could obtain an ample supply of a very excellent grade in which the flakes were large, clear and hand free. Since that time this grade has been required for other industries and it is now very difficult for the paint manufacturer to get it even if he could afford to pay the price.

The lowering of the grade of gum shellac affects seriously the protective properties of the paint. A test made from September, 1912, to April, 1913, on the bottom of the U. S. S. *South Carolina* showed that bottom paints made with a slightly inferior grade of gum shellac fell off the bottom, while paints made from the better grade did not.

During the past four years efforts have been made to successfully substitute pure garnet lac for gum shellac. These experimental paints would give good results if it were possible to get them applied, but the spirit varnish made from garnet lac acts in a very peculiar way toward the other ingredients. The pigments in the anti-corrosive paint rapidly settle and harden, while the anti-fouling paint congeals within 24 hours to such an extent that it cannot be applied with a brush. It has been found that the addition of approximately one ounce of potassium hydroxide per gallon of paint prevents these peculiarities, but it still remains uncertain whether the hydroxide accelerates corrosion of the steel painted. This matter is still under investigation.

Shellac wax, bee's wax, rosin and pine tar pitch have been used separately and in conjunction with gum shellac or garnet lac and have given negative results. A pure grade of T.N. gum shellac has been tested, but in none of these efforts have results been equal to results from using the high grade gum shellac.

Rosin has especially been of interest because of its low cost and because it is used with apparent success by some of the foreign navies, but rosin, like gum shellac, has many grades. Possibly the right grade has not yet been used in the experiments. The grade that has been used gives a weak film that cracks and softens under water and the paints fail because of rust within three months.

The use of rubber to strengthen the film produced by the lower grade gum shellac in anti-corrosive paint, over which were applied Norfolk anti-fouling or an experimental anti-fouling paint, showed that the rubber had no effect on the anti-corrosive properties but did improve the anti-fouling properties of the paints applied over it. Here it may be stated that in 1907 a naval officer observed that an iron caisson at Pensacola, Fla., had not fouled although it had been in the water several years. This caisson was coated on the underwater part with rubber. Tests made with red gum (Yacca gum) as a substitute for gum shellac gave excellent results.

The use of turpentine (spirits) instead of the cheaper petroleum spirits is not believed to be warranted. During 1913 and 1914 tests on four bottoms, made by quartering and painting diagonally opposite quarters with bottom paints containing petroleum spirits instead of turpentine, failed to show any difference. On one of these bottoms (the U. S. S. *Michigan*) the test was repeated and still no difference was obtained.

Pine tar oil is used in the paints to give slight flexibility to the film. However, pine tar oil contains much free pyroligenous acid which attacks first the metallic zinc in zinc dust used in anti-corrosive paints. In 80 days the paint evolves a volume of gas which, at atmospheric pressure, is equal to the volume of paint. This accounts for the tendency of the anti-corrosive paint to be forced out of leaks around the filling hole of containers. The paint cannot successfully be stored in wood barrels for the same reason.

Pine oil has been used with varying degrees of success as a substitute for the pine tar oil, the turpentine and a part of the alcohol. From a technical standpoint such paint is better than the Norfolk paints, but the odor of the pine oil is obnoxious. The men applying the paint complain of its effect. This probably accounts for its use being abandoned after several vessels had been painted.

It would be highly desirable to substitute for the pine tar oil in the Norfolk formulæ an oil which would give the same flexibility to the film and which would be free of acids and

* Assistant shop superintendent, United States Navy Yard, Norfolk, Va.

disagreeable odor. Castor oil, used to the extent of 2 gills per gallon of paint, causes blistering of the film, but these small blisters do not seem to be detrimental. The Norfolk paints containing the castor oil are superior, during the first seven months' service. Boiled linseed oil, used in the same way the castor oil was used in the paints, gives negative results. The films crack and rust starts within two months.

A medium grade of zinc oxide (American XX) is used in Norfolk paints but a slightly leaded zinc has proven equally as efficient so far as results on submerged plates show. The sulphate of lead in the leaded-zinc should not exceed ten percent. When thirty percent sulphate of lead, leaded-zinc is used the results are negative and the paint pigments settle hard in the containers. It would seem desirable from the standpoint of cost and improvement of the quality of paint to reduce the amount of zinc oxide and add an inert pigment such as silica. Silica, as will be mentioned later, is an excellent pigment for ship bottom paints.

Zinc dust is supposed to be the ingredient in the anti-corrosive paint which prevents corrosion. The electrolytic theory for rust is adhered to in this supposition, it being held that the metallic zinc which constitutes 85 percent of the zinc dust, being electro-positive to iron, forms galvanic couples to prevent the rust. If this supposition is correct, as it seems to be, it would seem to be desirable to increase the proportion of zinc dust. It has been noted that rust is usually prevented as long as the particles of zinc dust are present in the film and that rust starts soon after these particles have disappeared. Powdered metallic zinc gives better results than zinc dust, which is only 85 percent metallic zinc, but is expended more rapidly. The original Norfolk formula required a larger proportion of zinc dust (metallic zinc) and apparently produced a better paint than the present standard. Of course there is the ever present liability of zinc dust to spontaneous combustion, a feature that should be considered separately from a discussion of this character.

Indian red is possibly the least influential ingredient in the bottom paints, yet there are possibilities of much being done in the selection of the proper quality. Several kinds have been tested, some giving slightly positive and some decidedly negative results. It is believed that the success of the British Navy paints is due in part to a fortunate selection of their iron oxide pigment which is obtained from ore mined in England. Again, it may be that Indian red is altogether the wrong pigment to use with the zinc oxide because a weak galvanic action is set up between particles of the two pigments but it is used in Norfolk anti-fouling ship bottom paint to give body and to make the color distinctly different from the anti-corrosive paint, the latter property being highly desirable for insuring that all parts of the ship's bottom are coated.

Finally the toxine, mercuric oxide, is to be considered. Compounds of mercury are used, or have been used, in most anti-fouling paints for steel bottoms. Only red mercuric oxide was once used in Norfolk anti-fouling, but of recent years red or yellow mercuric oxide has been used as the toxic qualities of the two, so far as service is concerned, seem to be equal. Originally 47½ pounds per 100 gallons of paint were used but this has been increased so that now 75 pounds per 100 gallons of paint are used. This change occurred in August, 1914, after considerable testing on ship's bottoms as well as on submerged plates.

Mercuric oxide is a very heavy pigment, its specific gravity being entirely out of proportion to all the other ingredients of the paint. This causes the pigment to settle rapidly and, in order to get an approximately even distribution of the pigment on a bottom, it is necessary to do much stirring both before the paint is taken from its shipping container and after it is poured into buckets from which it is applied. After the paint is applied there is only a shellac film holding it and as the shellac film usually softens in 48 hours after submersion it is reasonable to expect that much of the mercuric oxide is then lost.

During November, 1914, the bottom of the U. S. S. *Paulding* was found to be clean of fouling except for scattered bunches of hydroids about five inches long. The paint under these hydroids was found to be free of mercury.

Copper salts have been considered unsuitable on steel hulls because of the known effect of the presence of metallic copper adjacent to submerged surfaces of steel (or iron). However, some very interesting results have been obtained when using copper salts instead of mercuric oxide in Norfolk paint. From May to October 1921, a submerged plate showed that cuprous oxide would not prevent barnacles from becoming attached, but the experimental film remained harder and freer from rust than did the standard film. Copper cyanide gave slightly positive results during a ten-month (January to October) submersion test, but the film showed early blistering followed by small beads of rust. When copper cyanide was used as the toxine in a formula varying greatly from the Norfolk formula the results were decidedly negative and the film caught the first crop of barnacles and hydroids.

Arsenic trioxide and orpiment have also been tried and gave negative results. The former is possibly too soluble in water and the latter gave fair results for two months (February and March) but was not effective as a toxine when the barnacle season opened.

Paris green has been tried in a number of tests. It is a most excellent pigment and toxine but unless it is supplemented with mercuric oxide, or an equivalent toxine, it does not prevent fouling. When so supplemented the results are decidedly positive. Its relative cheapness permits its use as a part of the body pigment and as such it is quite suitable.

Mercuric linoleate, copper linoleate, zinc cyanide and cuprous hydrate have been tested in a preliminary way, in one submerged plate test, and each has failed to prevent fouling by barnacles.

The conclusion can logically be drawn that in order to prevent fouling by poisoning it is necessary to use a toxine for organisms of the animal kingdom and a toxine for organisms for the vegetable kingdom. So far as the writer's experience goes no one substance has been found toxic to both that can be used effectively in an anti-fouling ship bottom paint. This statement does not take into consideration those paints which prevent fouling by exfoliation, with which very little experience has been had. One test has been made with a heavy petroleum grease applied over bottom paints. The grease was supposed to prevent attachment of fouling by preventing secure attachment. The results were negative and the grease caused the anti-fouling paint beneath to crack and flake.

In December, 1915, an effort was made to analyze the results from approximately 75 tests to determine the relative merits of various pigments used. The tests were made on submerged plates, each being examined monthly for eight months. Two coats of anti-corrosive paint and one coat of anti-fouling paint were applied in each case. The results were graded on the basis of ten being perfect and the average grade for each pigment was determined as the average grade on all paints in which the pigment was used. The same vehicles as are used in Norfolk paints were used in most of these tests. The results were:

Pigment	Anti-corrosive	Anti-fouling
Zinc oxide	4.2	3.74
Silica	5.2	3.65
Blanc-fixe	4.	5.2
Artificial vermillion	3.11	2.87
Indian red	..	3.2
Orpiment	..	4.86
Paris green	..	5.4
Proto oxide of copper	..	4.1

These grades indicate that silica is an excellent pigment for an anti-corrosive paint and that blanc-fixe is an excellent

pigment for anti-fouling paint. They also indicate that Indian red is not a desirable pigment for anti-fouling paint. Red lead in an oil paint, in a flat paint and in a spirit varnish paint has been tried as a primer for anti-fouling paint; that is, as an anti-corrosive paint. It has also been tried in combination with basic sulphate of lead. In all these tests the results have been negative. However, red lead oil paint applied on hulls while building, and which has at least three months to dry before ship bottom paints are applied, gives better results.

Tests of Vehicles

The determination of the proper vehicle for ship bottom paints is equally as important as the determination of the proper pigments. Some effort has been given to determine the proper ratio of gum shellac to volatiles, but the data obtained are not sufficient upon which to base a conclusion. It is believed, however, that the ratio should be greater for anti-fouling than for anti-corrosive paint. The anti-fouling must hold heavy toxines and must assist in binding the anti-corrosive paint's pigments to the ship's bottoms. Other kinds of vehicles have been tested, for example, an anti-corrosive paint in which a linseed oil product was used with Portland cement as the pigment. The results were excellent, but the drying time was prohibitive. The linseed oil compound used without pigment (as a waterproof coating) and applied next to the steel gave poor results.

Chrome yellow used with this oil compound formed an excellent anti-corrosive paint, but dried too slowly. Chrome yellow used in a spirit varnish anti-corrosive gave poor service.

Asphalts were used as the binder for anti-corrosive and anti-fouling paints on one plate and all the paint came off within three months. Asphalt bottom paint tests made at a naval station in the Philippine Islands gave much better results. Coatings of shellac between the anti-corrosive and anti-fouling paints prove ineffective.

One very interesting test of an intermediate varnish coat was made by applying a hard gum varnish over the seams and rivets of a bottom before applying Norfolk anti-fouling paint. When the vessel was again docked it was clean of fouling except where the hard gum varnish had been applied. Here was found a heavy growth of hydroids and crustaces where the varnish had caused the anti-fouling paint to check and fall off. The bottom had a checker board appearance.

Whatever type vehicle is selected for the anti-fouling paint, the same type vehicle should be used in the anti-corrosive paint. There should not be a marked difference in elasticity between the two paint films.

Combination Ship Bottom Paint

It was suggested above that possibly the properties of an anti-corrosive and of an anti-fouling ship bottom paint could be combined in one paint. The belief that this can be done is based upon the fact that it is the built-up film on a bottom that gives the best protection. By built-up film is meant that film produced by applying fresh paints over old paints. When a ship is placed in drydock the slime and fouling are removed. This can usually be done by washing or by scraping with square point shovels. The paint adhering to the bottom is not removed. The bare spots are then touched up with anti-corrosive paint, after which the bottom is given one or two complete coats of anti-corrosive over which is applied the anti-fouling paint. In time there is built up a comparatively heavy coating of paint consisting of alternate layers of anti-corrosive and anti-fouling. If a coating consisting of layers of different paints gives good service, why would not a coating in which the different paints are more thoroughly mixed give good services?

Often a ship bottom is painted when it is in a fair condition in order to assure that the condition will be maintained until the time for the next docking. One coat of anti-corrosive and one coat of anti-fouling is the minimum that can be applied to protect against both rust and fouling. If a combination paint were available one-half of the labor and time could be saved by applying one coat of the combination paint. The demand for such a paint is great. When it is produced, and eventually it will be produced, the ship bottom paint trade will have to conform to the demands.

The following formula has been tested on a submerged plate from July to January, during which period two coats of it gave better service than did two coats of Norfolk anti-corrosive and one coat of Norfolk anti-fouling paints. The combination paint film was hard and clean of fouling and rust at the end of six months' exposure.

To make 25 gallons:

Grain alcohol	13¾	gallons
Gum shellac	40	pounds
Pine oil	2½	gallons
Zinc oxide	30	pounds
Silica	30	pounds
Blanc-fixe	30	pounds
Paris green	15	pounds
Mercuric oxide	10	pounds

This paint weighs approximately 11 pounds per gallon, and dries equally as fast as do the Norfolk paints. It should be borne in mind, however, that this formula has been tested on only one submerged plate. It has not been tested on a ship's bottom.

Referring again to the merit of a built-up film, it can be stated that in making tests attention should be given to the effects produced by a built-up film. It is not sufficient to condemn a paint because the first coats on a steel plate do not prevent rust for a period of six months. The test should be continued by removing the rust and fouling and repainting. In this way a film is built up which possibly will give the desired service. Again, when painting sections of a bottom with an experimental paint, the results from the first painting are often not due entirely to the experimental paint, but to the built-up film consisting of the experimental paint and the paints previously used. These facts are so elementary that wonder is had at conclusions sometimes drawn from tests.

Tests Now in Progress

During the past ten months there has been a renewed activity in tests of ship bottom paints. Preliminary tests, to find suitable vehicles other than the present standard vehicle, indicate that aeroplane dope is not suitable. A spar varnish containing both linseed and tung oil apparently is unsuitable and an ester resin, dissolved in benzol, presents some likelihood of having merit, but the tests have not advanced sufficiently to warrant any conclusion.

A series of interesting tests is in progress at Beaufort, North Carolina, where the Navy has a chemist stationed temporarily in the Bureau of Fisheries Laboratory. These tests will be continued on steel plates submerged at the Norfolk Navy Yard.

Other tests are being made of ship bottom paints having barium salts as the toxine and several vessels are now painted with such paint on two quarters of the bottom.

In addition copper cyanide is being further investigated as is also cuprous oxide.

Conclusion

The problem of finding the best formulæ is an intensely interesting one and the solution is not found when a pigment or pigments are found which are toxic to all forms of marine growth. An effort has been made in the foregoing to show that the problem covers physical as well as chemical properties of the paint film.

In 1906 the Navy used approximately 25,000 gallons of ship bottom paint. The Navy now uses approximately 200,000 gallons of ship bottom paint per year.

A recent review of reports during the past 4 years showed

that the effectiveness of the anti-corrosive paint is good for a period of from 12 to 18 months and the effectiveness of the anti-fouling paint is good for 9 months. Considering averages, vessels out of dry dock nine months are in as good condition as those out of dock only six months.

Corrosion develops slowly between the twelfth and eighteenth month and rapidly after that.

These periods are suggested from the records of 303 examinations; 134 for vessels out 6 months, 64 for vessels out nine months, 66 for vessels out 12 months, 27 for vessels out 18 months and 12 for vessels out 24 months. The records cover all types of vessels plying in all waters traversed by United States Naval vessels.

Results of Experiments

Table 1 contains information of tests conducted at the Norfolk Navy Yard with 21 experimental paint compositions. Some of these paints were tested on submerged steel plates, some on the bottom of launch number 270 and others on the bottoms of coal barges numbers 69 and 74.

The submerged steel plates were painted with two coats of anti-corrosive paint and one coat of anti-fouling paint. The results were:

Formulæ	Period of Submersion	Results
No. 1 A. C. and No. 2. A. F.	May 30, 1906 to July 30, 1906	Poor. Paints soft and covered with barnacles and rust cones.
No. 1 A. C. (No anti-fouling)	May 31, 1906 to July 30, 1906	Poor. Covered with rust, barnacles and grass.
Commercial brand A. C. and A. F.	May 31, 1906 to July 30, 1906	Fair. Few barnacles, no grass, slight rust.
Commercial brand A. C. and A. F.	May 31, 1906 to Dec. 20, 1906	Many large barnacles. Much corrosion in form of black oxide. Paints soft.
No. 3 A. C. and No. 4 A. F.	June 14, 1906 to Dec. 20, 1906	Paint soft. Few scattered barnacles and large rust cones. No grass.
No. 5 A. C. and No. 4 A. F.	June 21, 1906 to Dec. 20, 1906	Large cracks in film in which rust developed. No other rust on plate. No barnacles. No grass.
No. 6 A. C. and No. 7 A. F.	Aug. 9, 1906 to Dec. 20, 1906	Few barnacles. Little grass. Much slime. Small amount of rust. Oil sweats out of film. Paint soft. Fair condition.
No. 12 A. C. and No. 13 A. F.	Sept. 21, 1906 to Dec. 20, 1906	Slight blistering. No rust. No fouling.
No. 20 A. C. and No. 21 A. F. (plate polished)	Oct. 20, 1906 to Dec. 20, 1906	No fouling. Rust cones started. Slight pitting noted after the paint was removed.

Launch No. 270 was painted September 4, 1906, and the bottom examined December 22, 1906. The bottom had been galvanized but the galvanizing had worn off at the time of the test. Sections 12 feet long extending from the waterline to keel on one side were used for these tests. The results were:

Formulæ	Results
No. 3 A. C. and No. 4 A. F. (HgO added to 2nd and 3rd coats)	No rust. No grass. Few barnacles. Paint in excellent condition when first taken out of water but began to peel in 24 hours after exposure to air.
No. 5 A. C. and No. 9 A. F.	Few barnacles. No grass. Few rust cones where paint was chipped off. Paint scales when exposed to the air after submersion.
No. 3 A. C. and No. 4 A. F.	Conditions about the same as first item. There were small rust cones where paint was chipped off.
No. 5 A. C. and No. 9 A. F.	Numerous barnacles and moderate amount of grass. No rust. Paint hard and did not scale on exposure to air.
No. 10 A. C. and No. 11 A. F.	No rust. No grass. Few barnacles. Paint hard but scaled upon exposure to air after submersion.
Commercial brand A. C. and A. F.	Paint off from numerous spots, but remaining paint was hard. General corrosion started. Numerous rust cones. Numerous barnacles, moderate amount of grass. Paint does not scale on exposure to air.

General Comparison

The anti-fouling test paints, with the exception of Number 9, were effective. All the paints were less effective at the waterline than well below the waterline. Where submerged all the test paints proved superior to the commercial paint. All the paints scaled on exposure to air, after submersion, except those designated as Numbers 5 and 9 and the commercial paint.

Coal barge Number 69 was painted September 23, 1906; examined January 18, 1907, and again on October 3, 1907. It was sunk in Hampton Roads April, 1907, and raised October 1, 1907. The test paints were damaged and much of the fouling removed by passing chains under the barge to raise it. The test sections were 8 feet long and extended from the load waterline to the turn of the bilge on both sides. The results were:

Sec. Formulæ	Condition Jan. 18, 1907	Condition Oct. 3, 1907
(1) No. 3 A. C. and No. 4 A. F.	Paint hard; slightly scaled. Many small barnacles and slight amount of grass.	Fair condition. Very small amount of rust. A moderate amount of small barnacles and scattered bunches of grass.
(2) Commercial brand A. C. and A. F.	Covered with small barnacles and short grass. Paint off in some spots.	Very bad condition. Dense growth of small barnacles, clams and worms. Practically no grass. Considerable rust.
(3) No. 14 A. C. and No. 4 A. F.	Few barnacles and small amount of grass. Paint hard but scaling at water line.	Conditions much better than on section 2. The anti-corrosive better than that on section 1. About equal to section 1 as to fouling.
(4) No. 15 A. C. and No. 4 A. F.	No grass. Very few barnacles. Paint hard and in good condition.	Same conditions as on section 3.
(5) No. 16 A. C. and No. 4 A. F.	Approximately same condition as and slightly better than, section 4.	Conditions similar but slightly superior to conditions on sections 3 and 4.
(6) No. 17 A. C. and No. 4 A. F.	Few barnacles. No grass. Paint in excellent condition.	Conditions very similar to conditions on sections 3, 4 and 5.
(7) No. 3 A. C. and No. 4 A. F. (Same as sec. 1)	Condition approximately same as section 1, but slightly worse as to scaling.	No report.

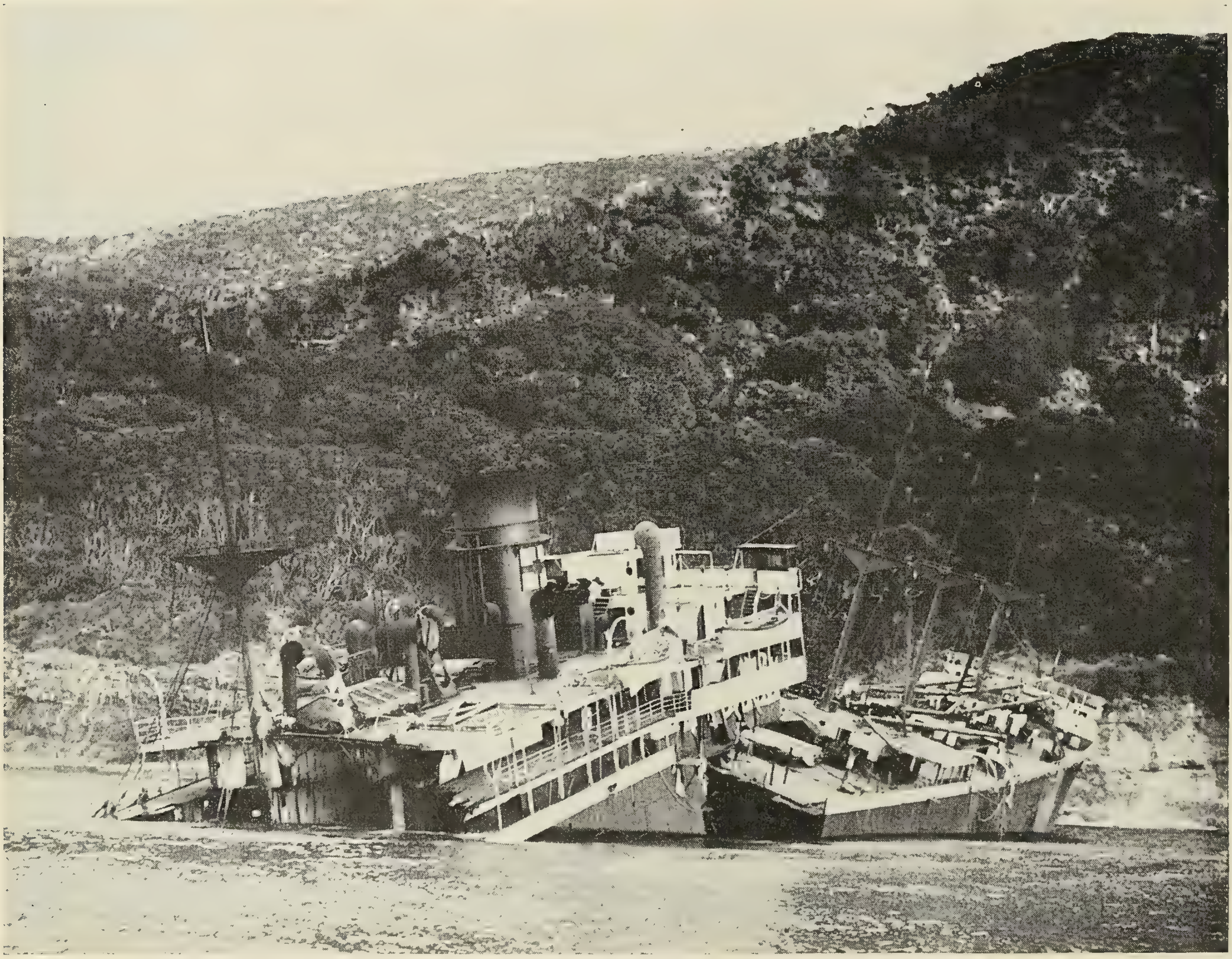
The order of merit on January 18, 1907, was sections 2, 7, 1, 3, 4, 5 and 6; section 2 being the worst condition and 6 the best condition.

Coal barge Number 74 was painted October 1, 1906, and was examined February 21, 1907, and October 3, 1907. The bottom was sectioned similarly to the bottom of coal barge Number 69 described above. During most of the period of test the barge was moored at the Norfolk Navy Yard. It was used in raising coal barge Number 69 when the experimental paints were more or less damaged by chains. The conditions were:

Sec. Formulæ	Condition Feb. 21, 1907	Condition Oct. 3, 1907
(1) Commercial brand A. C. and A. F.	Paint scaling. Almost covered with small barnacles, some grass and much slime.	Most of paint disappeared. General corrosion and pitting. Dense growth of grass with scattered barnacles.

Sec. Formulæ	Condition Jan. 18, 1907	Oct. 3, 1907
(2) No. 14 A. C. and No. 19 A. F. (with bitter aloes added to A. F.)	No scaling below water line. No rust. Many small barnacles but not so many as on section 1. Film hard. Scaling at water line.	Paint hard. Very good anti-corrosive paint. Anti-fouling in fair condition. Much better than on section 1.
(3) No. 15 A. C. and No. 19 A. F. (with arsenious acid added to A. F.)	Very slight scaling at water line and no scaling below water line. Less barnacles than on section 2. No grass. Film hard.	Paint hard. Very good anti-corrosive paint. The anti-fouling was not equal to that on section 2 but better than that on section 1.
(4) No. 16 A. C. and No. 19 A. F.	No scaling. Rust cones where paint had been scraped off (shell plate dented here showing collision had occurred). More barnacles than on section 3. No grass and but little slime.	Paint hard. The best of the anti-corrosive paint. Anti-fouling paint in fair condition; much better than that on section 1.
(5) No. 17 A. C. and No. 19 A. F.	Practically same condition as section 4.	Paint hard. Very good anti-corrosive paint. Anti-fouling paint in fair condition; much better than that on section 1.
(6) No. 3 A. C. and No. 4 A. F.	Considerable scaling. Rust cones where paints had been scraped off. Very few barnacles. No grass.	Condition of anti-corrosive paint is only fair, inferior to that on sections 2 and 5. Anti-fouling paint in fair condition much better than that on section 1.
(7) No. 18 A. C. and No. 19 A. F.	Considerable scaling. Numerous blisters. Fouling about same as sections 4 and 5.	Poor anti-corrosive but better than the commercial brand. Condition of anti-fouling paint fair; much better than that on section 1.

The best anti-corrosive paints (February 21, 1907) were Numbers 16 and 17; the most inefficient anti-corrosive was Number 18. The best anti-fouling paint (February 21, 1907) was Number 19 with arsenious acid added (section 2).



(Photograph from Keystone View Company, Inc., N. Y.)

The Wreck of the Wiltshire

The English Federal steamer Wiltshire was recently stranded on the Great Barrier Island of New Zealand, Australia. During a severe storm while she was stranded, the vessel broke in half and disabled the wireless apparatus, but the crew was able to communicate with the shore by semaphore signalling, and after forty hours was brought ashore. The photograph shows the condition of the vessel after the crew was rescued.

Insulating Materials for Shipbuilding Purposes—II

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

MINERAL wool is fibrous material formed by blowing molten slag or rock into threads by means of a jet of steam or air. Other names are mineral cotton, slag wool, rock wool and silicate cotton. The product made from rock is the best.

Mineral Wool

Mineral wool made from slag contains a small amount of sulphur unless the molten slag has been specially desulphurized, and such wool should therefore not be used as packing around steelwork on shipboard or as a covering for steel pipes or other steel containers. Access of water to mineral wool containing sulphur may result in the formation of sulphuric acid, with attendant rapid corrosion of the steel.

One manufacturer liquifies silica bearing limestone rock at a temperature of 3,500 degrees F. and blows this liquid rock into fine threads by means of a steam blast. The threads on their way to a cooling chamber are passed through oil vapor, which makes them soft and pliable and removes the minute particles of stone dust. The product looks much like cotton linters. A cubic foot of this rock fiber wool contains 8⅓ percent rock fiber and 91⅔ percent of entrapped air when packed to a weight of 14 pounds per cubic foot.

The chief field for mineral wool is the insulation of refrigerated cargo spaces. It is also of value for packing in between deck beams wherever the underside of a deck has to be insulated, as when the ship's cold storage rooms are over the machinery space.

Specifications for the material should require it to be of good quality, reasonably free from shot and other deleterious matter. Small globules of glass or stone not properly blown into threads are called shot.

Hair Felt

This material is felted cattle hair. It has high insulating properties and is considerably used for covering ammonia and brine pipes. It can be obtained in rolls in thicknesses from ¼ inch to 2 inches, and can be built up on the pipes.

Specifications should call for the best commercial grade used for pipe-covering insulating purposes.

A sectional covering is available suitable for cold water piping to keep the water cold and also to guard against condensation on the pipes. It is made up in standard sections, molded and compressed over a lining of waterproof paper. It is canvas jacketed and fitted with bands for fastening. A thickness of ¾ inch will answer for this service.

There are special coverings made of hair felt and other materials, some of which are very efficient.

Wool Felt

This is made up as a pipe covering in the same manner as hair felt, and the same remarks apply. The covering for hot pipes has been referred to. For cold pipes it has an inner lining of waterproof saturated felt.

In some cases the plain wool felt covering has all surfaces coated with a waterproof preparation, so that moisture will not get to the wool felt.

A more waterproof type of covering is made of alternate layers of wool felt and waterproof paraffin paper with an inner lining of paraffin paper.

There are also special combinations of wool felt and other materials in layers.

Vegetable Fiber Products

Some of these products have been found to fulfill shipboard requirements as refrigerating insulation. As stated under the head of heat retaining insulation, any of them which may be presented for consideration can be readily examined for everything except durability and the character of the ingredients is a good guide to that.

One of these products is waterproof lith, which is composed of 40 percent by volume of flax fibers, 58 percent of the limestone rock wool referred to under the head of mineral wool, and 2 percent of a waterproofing compound. It comes in boards 18 inches by 48 inches, from ½ inch to 3 inches thick. It weighs about 1⅓ pounds per square foot 1 inch thick and 3½ pounds 3 inches thick. It is a substitute for corkboard in service for which corkboard is the standard material.

The above product is also made up into sectional covering for pipes and fittings, using the same materials but specially selected and made somewhat more dense. The surfaces are coated with a waterproof compound. The thicknesses for the different services are the same as given under the head of cork pipe covering except that the ice water covering averages 1¾ inches thick.

Another product, linofelt, has been explained under the head of heat retaining insulation. Its particular field is small refrigerated rooms and ice boxes.

The nature of insulating paper has also been explained under the head of heat retaining insulation. Its principal value in refrigerating insulation work is to prevent losses due to joints in the main insulating materials.

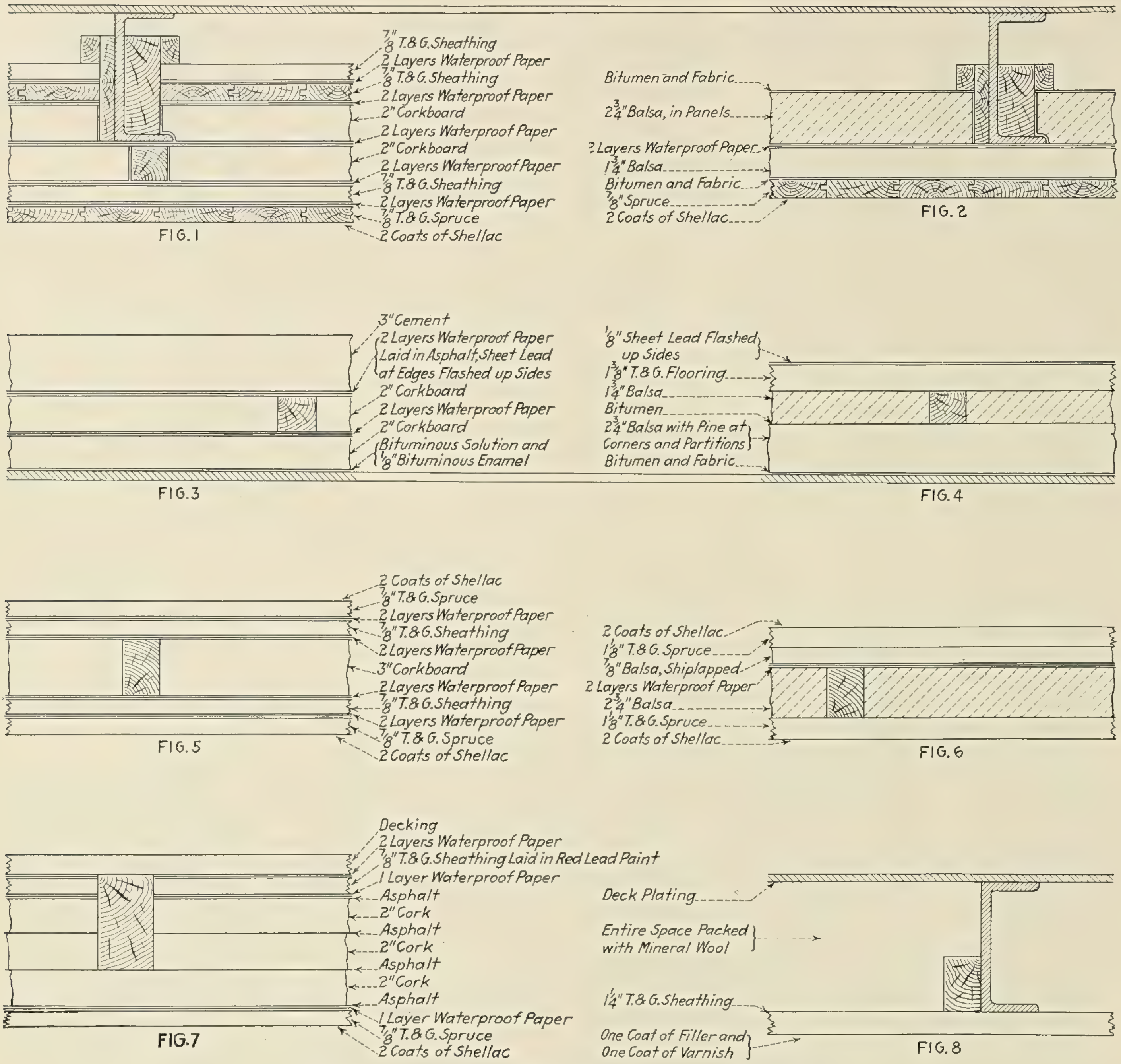
Method of Use

The accompanying illustrations give a general idea of the way refrigerated spaces are insulated on shipboard. Figs. 1 to 7 show typical installations for meat and vegetable rooms, the former being generally kept at a temperature of 20 degrees F. and the latter at 40 degrees F. Fig. 8 shows a typical installation in the cargo space of a refrigerated ship.

Figs. 1 and 2 represent either the under side of the deck or the side of a steel ship and afford a comparison in the construction with corkboard and with Balsa wood. The saving in wood sheathing with the latter is very apparent. The stiffener side of steel bulkheads calls for the same general layout except that when the stiffeners are angles it is usually better to run the corkboard or other insulating material entirely clear of the stiffeners.

Figs. 3 and 4 represent the insulation on a steel deck and also afford a comparison between the corkboard and Balsa wood constructions. The top coverings could of course be the same in each case and might differ from either of those shown. A cement covering on top of the Balsa wood in place of the wood flooring calls for the use of waterproof paper as shown for the corkboard insulation.

* Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.



Methods of Insulating Refrigerated Spaces on Board Ship

Figs. 5 and 6 represent partition bulkheads.

Fig. 7 represents corkboard insulation as applied to the under side of a wood deck, the beams being of such size as to make this method work out to better advantage than a layout similar to that of Fig. 1. The bitumen between the layers of corkboard is recommended by the corkboard manufacturers in preference to the waterproof paper. It is mopped on hot.

Fig. 8 represents the construction where mineral wool is used. The wood grounds are fastened to the frames or beams at the necessary distance from the plating to allow of the thickness of insulation called for, in some cases extending beyond the framing and making a packing space greater than the depth of the framing. A typical schedule covering the principal items of refrigerating insulation for the cargo spaces of a frozen meat carrying steamer, where mineral wool is used and where the temperature has to be maintained at not over 15 degrees F. under tropical conditions is—

Ship's sides	12 inches of mineral wool.
Underside of weather deck	10 inches of mineral wool.
Underside of second deck	8 inches of mineral wool.

Tank tops	6 inches of cork in two layers.
Machinery space bulkheads	11 inches of mineral wool.
Intermediate bulkheads	4 inches of mineral wool on the smooth side; the depth of the stiffeners on the stiffener side.
Shaft tunnel	10 inches of mineral wool.

In cases where the insulation under a deck is in the machinery space it is desirable to apply 2 inches of 85 percent magnesia or equivalent insulation below the wood sheathing, with an outer facing of thin galvanized iron.

Waterproof lith of the necessary thickness may be substituted for corkboard in the illustrations, and its manufacturers recommend a heavy bitumen coating mopped on hot between layers of this material rather than waterproof paper, although approving the paper as a substitute for the bitumen between the lith and wood sheathing.

Miscellaneous Heat Resisting Insulation

Insulation that is of value to retain heat is naturally of value to exclude it, so that a consideration of miscellaneous heat resisting insulation resolves itself mainly into pointing out which of the materials heretofore dealt with can be used

to advantage for such service. They will therefore be referred to under the head of some of the more important services of this character.

Underside of Wood Decks Over Boilers

The nature and extent of the insulation depends upon the closeness of the woodwork to the boilers and the air circulation in way of it. A typical installation for severe conditions consists of 1½ inches of 85 percent magnesia blocks set 2 inches clear of the wood and protected and secured in place by light galvanized iron. Other non-combustible insulation equivalent to the 85 percent magnesia could be used.

Inside of Engine and Boiler Casings

The protection in way of the stack might be as specified above for decks over boilers, with reduced thickness at the ends of the casings. Two-inch corkboard is used in some cases.

A good insulation for casings that are pretty well ventilated consists of 1 inch thick asbestos paper air cell blocks covered with galvanized sheet iron. The fastenings are run through 1 inch thimbles to prevent crushing the insulating material and the heads of the fastenings are completely soldered over.

Living Rooms Near Heated Spaces

The floors of staterooms or other accommodations over boiler rooms or galleys on steel ships can be protected in the manner illustrated by Figs. 3 and 4 for refrigerated rooms. A single layer of 1-inch cork will usually be sufficient, laid in bituminous solution and enamel as shown, with two layers of insulating paper and the required wood or composition deck covering on top. As stated in the article on "Deck Coverings"* the latter covering cannot be successfully used on steel decks which are exposed to excessive heat without some protection from that heat.

Joinerwork of accommodations in way of engine and boiler casings or galleys can be insulated by any of the good vegetable fiber products that are sufficiently fireproof as well as the materials which are primarily intended for more severe service.

Protection in Way of Stove Pipes, Stoves, Radiators, etc.

Asbestos millboard is the usual material for such service and it is usually necessary to protect it from damage by a covering of sheet metal. A thickness of 1/16 inch is sufficient.

Engineer's Consumable Stores

It is customary to have in the engineer's consumable stores a small supply of some of the insulating materials used on board of the ship together with the other materials necessary for their proper installation. The latter have been referred to under the head of some of the coverings and those references should be understood generally to apply to substitute coverings of like nature. Such a supply for the usual run of cargo steamships would be about as follows:

Fire bricks, assorted sizes as required	About 200.
Fire clay or high temperature cement	200 pounds.
Poultry wire, iron, 2-inch mesh, No. 14 B.W.G., annealed	10 pounds.
Asbestos plaster, two bags	100 pounds.
Asbestos cement, hard finish, one bag	50 pounds.
Asbestos millboard, 40-inch by 40-inch by ¼-inch thick	4 sheets.
8-ounce canvas for pipe covering	10 square yards.
Unbleached muslin for pipe covering, 2½ square yards per pound	25 square yards.
Cotton twine for pipe covering, No. 6, 1,000 yards per pound	one ½-pound ball.
Smooth-on	5 pounds.

*See Marine Engineering and Shipping Age, March and April, 1922.

Table I—Thermal Conductivities of Various Insulating and Building Materials

All the figures given below, with the exception of the first two, are the results of measurements made at the Bureau of Standards, Washington, D. C., on representative samples of materials. They represent actual internal conductivities, surface effects having been eliminated. The mean temperature of the determination was about 77 degrees F., and the temperature differences used varied from 50 to 77 degrees F.

K is the thermal conductivity in B.T.U. per square foot per inch of thickness per degree F. difference in temperature per 24 hours.

Material	Description	K	Pounds Per Cubic Ft.
Vacuum	Silvered vacuum jacket—residual air about 0.001 m.m. Hg	0.1	...
Air	Ideal air space—if radiation or convection could be prevented	4.2	0.08
Calorox	Fluffy finely divided mineral matter	5.3	4.0
Kapok	Imported vegetable fibre—loosely packed	5.7	0.88
Pure wool		5.9	6.9
Pure wool		5.9	6.3
Hair felt		5.9	17.0
Pure wool		6.3	5.0
Keystone hair	Hair felt confined with building paper—flexible	6.5	19.0
Mineral wool	Loosely packed	6.3	12.0
Mineral wool	Medium packed	6.6	12.5
Corkboard	No artificial binder—low density	6.7	6.9
Mineral wool	Felted in blocks	6.9	18.0
Cotton wool	Loosely packed	7.0	...
Pure wool		7.0	2.5
Insulite	Pressed wood pulp—rigid	7.1	11.9
Mineral wool	Firmly packed	7.1	21.0
Linofelt	Vegetable fibre confined with paper—flexible and soft	7.2	11.3
Ground cork	Ordinary	7.1	9.4
Corkboard	No artificial binder—high density	7.4	11.3
Celite	Diatomaceous earth powder	7.4	10.6
Granulated cork	About 3-16 inch	7.5	8.1
Balsa wood	Very light wood untreated — across grain	7.5	7.1
Balsa wood	Same sample with 13 percent waterproofing compounds	8.3	8.0
Cotton seed hull fiber	Loosely packed	7.5	4.4
Cabot's quilt	Eel grass enclosed in burlap	7.7	16.0
Flaxlinum	Felted vegetable fibres — firm and flexible	7.9	11.3
Fibrofelt	Felted vegetable fibres — firm and flexible	7.9	11.3
Rock cork	Mineral wool and binder—rigid	7.9	16.0
Ceiba wood	Untreated—across grain	7.9	7.1
Balsa wood	Light wood—untreated	8.3	7.4
Corkboard	Bituminous binder	8.4	16.0
Wood felt	Flexible paper stock	8.7	21.0
Lith board	Mineral wool vegetable fibres and binder—rigid (different somewhat from waterproof lith)	9.1	12.5
Balsa wood	Medium weight wood	9.2	8.9
Planer shavings	Various	10.0	8.8
Wall board	Stiff pasteboard	11.0	...
Air cell ½ in.	Corrugated asbestos paper enclosing air spaces	11.0	8.8
Air cell 1 in.	Corrugated asbestos paper enclosing air spaces	12.0	8.8
Asbestos paper	Asbestos and organic binder	12.0	31.0
Zenitherm	Diatomaceous earth and asbestos—rigid	11.8	16.0
85% magnesia	Magnesia and asbestos—rigid	12.2	19.0
Insulex	Asbestos and plaster blocks—very porous	13.5	18.0
Diatomaceous earth	Natural blocks	14.0	43.0
Balsa wood	Heavy wood	14.0	20.0
Fire felt sheet	Asbestos sheet coated with cement—rigid	14.0	26.0
Fire felt roll	Soft, flexible asbestos sheet	15.0	43.0
Cypress	Across grain	16.0	29.0
Fullers earth	Argillaceous powder	17.0	33.0
Asphalt roofing	Felt saturated with asphalt	17.0	55.0
White pine	Across grain	19.0	32.0
Asbestos millboard	Pressed asbestos—not very flexible	20.0	61.0
Mahogany	Across grain	22.0	34.0
Insulex	Asbestos and plaster blocks—porous	22.0	29.0
Virginia pine	Across grain	23.0	34.0
Oak	Across grain	24.0	38.0
Hard maple	Across grain	27.0	44.0
Parafine	"Parowax" melting point 52°C	38.0	56.0
Gypsum plaster		54.0	...
Asbestos wood	Asbestos and cement—very hard and rigid	65.0	123.0

Sound Proof Insulation

Sound waves upon reaching any material are either reflected, transmitted through it or absorbed. That material forms the best sound proof insulation which while possessing the necessary durability, ease of application and other qualities will absorb most of the sound.

The principal material used for sound proof insulation on shipboard is hair felt and the following extracts from Navy Department Specifications for sound proof lagging illustrate an approved method of its application:

This shall consist of hair felt in four layers, each layer 1 inch thick and weighing not less than 14 ounces per square foot, fitted between furring pieces and held in place by steel sheathing, which shall be secured to wood furring pieces. For large vessels

Table II

Material	Temperature Differences Deg. F.	B. T. U. per Sq. Ft. for 1" Thickness per Deg. F. Diff. in Temp. per 24 Hrs. Trans-mission	Conduc-tivity	Approx. Wt. per Sq. Ft. per 1" Thickness in Pounds	Relative Combustibility	Authority for B. T. U.
Fire brick	500–1500	257.0	....	12.5	Non combustible	Average
Nonpareil insulating brick	500–1500	20.3	....	2.33(a)	Non combustible	Manufacturer
Diatomaceous earth and asbestos	100 / 200	.... / 7.4	10.8 / 11.8	1.66(a)	Non combustible	Manufacturer
Sponge felted asbestos	100 / 200	8.2 / 8.6	....	3.5(a)	Non combustible	Manufacturer
85% magnesia	100 / 200	8.4, 9.1 / 9.0, 9.4	....	1.5, 1.4(a)	Non combustible	Two manufacturers
Asbestos felt	100 / 200	11.0 / 11.6	....	2.3(a)	Non combustible	Manufacturer
Air cell asbestos	100 / 200	11.0 / 12.4	....	.96(a)	Non combustible	Manufacturer
Hair felt	...	6.0	....	.66(a)	Smoulders but will not spread fire(a)	Union Pacific R. R.
Pure corkboard	...	6.6(c) / 6.4	....	.94(a)	Combustible slowly but will not spread fire	Union Pacific R. R. / Mass. Inst. of Tech.
Waterproof lith(b)	...	7.4	....	1.53(a)	Partially comb. but will not spread fire(a)	Union Pacific R. R.
Pure cork lagging	...	8.6	....	1.25(a)	(Same as pure corkboard)	Manufacturer
Wool felt	...	8.7	....	1.75	Smoulders but will not spread fire	Manufacturer
Corkboard with binder	...	8.9	....	1.5	(Same as pure corkboard)	Mass. Inst. of Tech.
Mineral wool with binder	...	9.1	....	1.33	Non combustible	Mass. Inst. of Tech.
Balsa wood — medium wood, medium treatment	...	...	10.7	1.22(a)	Combustible	Bureau of Stds.

(a) Same authority as for the B. T. U.
(b) The corresponding figures for 2 inch thickness are 5.0 B. T. U. and 2.53 pounds.
(c) The corresponding figure for 2 inch thickness is 4.2 B. T. U.

Table III

Material	Thickness In Inches	B. T. U. per Sq. Ft. per Deg. F. Diff. in Temp. per 24 Hrs. Trans-mission	Conduc-tivity	Approx. Wt per Sq. Ft. in Pounds	Relative Combustibility	Authority for B. T. U.
Asbestos paper	1/16	...	192.0	.34	Non combustible	Bureau of Stds.
Asbestos rollboard	1/8	...	96.0	.70	Non combustible	Bureau of Stds.
Asbestos millboard	1/8 / 1/4	22.4 / 18.4	.... /	.74(a) / 1.43(a)	Non combustible	Union Pacific R. R.
Cabot's quilt—3 ply	7/8	...	9.2	.36	Combustible but will not spread fire	Bureau of Stds.
Fireproof fibrofelt	1	9.0	....	.93(a)	Partially combustible but will not spread fire(a)	Union Pacific R. R.
Flaxlinum	3/4	7.4	....	1.07(a)	Smoulders but will not spread fire(a)	Union Pacific R. R.
Fireproof linofelt	3/4	7.3	....	1.17(a)	Smoulders but will not spread fire(a)	Union Pacific R. R.

(a) Same authority as for the B. T. U.

the sheathing shall be of 2½-pound plating except that for the floor shall be of 5-pound plating. For torpedoboat destroyers and other vessels of special light construction the sheathing shall be 17 mils thick except that for the floor shall be 2½-pound plating.

The spaces between the floor sheathing and the deck shall be filled with hair felt where the compartment is in the interior of the vessel or asbestos where the compartment has direct communication with a weather deck. The thickness of the floor insulation shall be suitably reduced where the deck height clear under beams (not taking account of the insulation) is less than 7 feet, with a minimum thickness of hair felt or asbestos of 1 inch.

For best results the lagging should cover as much as possible of all surfaces in the compartment which is to be soundproofed and should be fitted to full thickness over beams, stiffeners, etc.

A number of the vegetable fiber insulating materials previously dealt with have good sound insulating value and are advocated by their manufacturers for this purpose. Linofelt, Flaxlinum and Cabots Quilt are among them.

Mineral wool is used in some cases but the probability of its pulverizing, settling and leaving empty spaces is a decided objection to it.

The particular field of sound proof insulation on shipboard is the radio apparatus room. There are times when it is desirable to specially insulate some of the accommodations. Telephone booths and voice tube booths are sometimes insulated.

Electrical Insulation

The chief concern of the shipowner and shipbuilder apart from the wisdom of having this important insulation in line with the best practice is to see that it complies with the requirements of the National Board of Fire Underwriters and

the Rules and Regulations of the United States Steamboat Inspection Service, and, where a vessel is classed, with the requirements of the classification society concerned.

The United States Steamboat Inspection Service requires that—

Wires shall be run in approved iron conduits, armored casing or molding.

Iron conduit or armored casing shall be required in bunkers, cargo spaces, storerooms, etc., and in all places where the leads are liable to mechanical injury. Joints in wiring shall be avoided as far as possible in the above-named spaces. Where wires are led through beams, frames, or non-watertight bulkheads, they shall be carried either in iron conduits, armored casing or protected by hard rubber or other equivalent bushings.

Where wires are carried through watertight decks or bulkheads, they shall be provided with a suitable stuffing box at the deck or bulkhead. Where such points are liable to mechanical injury they shall be protected by suitable boxes or cages.

Joints shall be so spliced or the parts so joined as to be both mechanically and electrically secure without solder. They shall then be soldered and properly insulated and further protected by waterproof tape.

Also that the electrical installation including the wiring carried through wooden bulkheads, etc., shall be of such a nature as to preclude any danger from fire.

Rubber and porcelain are the two principal materials used for electrical insulation, the former to cover the conductors and the latter to insulate them from other materials to which they are attached or through which they pass. Hard rubber is also used for the last mentioned service.

Wiring which passes through bulkheads made of combustible material should be insulated from them by running them through tubes of porcelain, or other insulating material.

Insulation containing rubber is damaged by oil and particular attention has therefore to be given to the covering of electrical conductors on oil tankers. Particular attention should also be given to the insulation of wiring in locations where moisture is liable to collect. In both cases the wiring should preferably be lead covered.

Large Cranes for Shipyards and Harbor Service

Construction and Operation of 250-Ton Hammerhead and Floating Cranes Built in Germany for Fitting Out Large Ships

By E. Krahnen, M. E.*

In the so-called hammerhead cranes, the first of which was built by the Benrath Company (now Demag, Duisburg) a double cantilever is connected to a structural steel post which forms the central axis of a pyramidical frame work. The mechanism for lifting the load and for traversing the trolley are arranged entirely upon the trolley which travels on the front part of the cantilever, the tail end forming the balancing arm.

In later designs the lifting and traversing gears were usually arranged on the balancing arm, so as to minimize the weight of trolley and jib, the weight of the machinery acting as a counterweight. Also the form of the tower underwent a complete change. It now consists of a structural steel pyramidical column over which fits a frame-work to the head of which is fixed the cantilever.

The whole weight of the cantilever as well as the bell structure rests on the top of this central column and thus adds to the stability of the crane. The forces are transmitted to the column, the base of which is comparatively small. To reduce the friction to a minimum a combined roller and center bearing is placed on the top of the column while the lower extremity of the bell structure bears against a pressure ring.

Provisions are made to facilitate the inspection of the top bearing. By means of four hydraulic jacks the entire superstructure of the crane including the bell structure can be lifted without any preparations whatsoever and of a sufficient height to free the rollers and allow of removing any part of the bearing.

Auxiliary Slewing Jib

While the size and lifting capacity of these cranes could be increased in later designs it was not possible to increase the slewing speed of the jib on account of the enormous masses that had to be accelerated. This made these cranes rather unwieldly for handling smaller loads, up to about 20 tons, which form the bulk of the material to be lifted while the maximum loads have to be lifted only occasionally. To facilitate the handling of lighter loads, the Demag, Duisburg, introduced an auxiliary slewing jib crane of about 20 tons capacity that travels on a track laid on the upper flanges along the entire length of the cantilever. The main crab travels on a runway that is placed between the main girders. The jib crane is able to cover a fairly large area on both sides of the crane and permits of masts higher than the crane itself being placed in position.

An objection to the ordinary type of hammerhead crane is that the cantilever arm in rotating may foul the masts of vessels which are being fitted out. This has been overcome by fitting a derricking motion to the jib, Fig. 2, making the crane independent of the height of the deck superstructures because when the jib is derricked the crane revolves clear. As the crane shown in Fig. 1, built for the Blohm & Voss shipyard, Hamburg, embodies all these features a short description of it will be given.

Blohm & Voss 250-Ton Crane

In the design of this crane great care was taken to reduce the deadweight to the utmost so that the crane could be worked with the least power possible. Owing to the great many ways the load may be applied in addition to the numerous motions that had to be performed the calculations were of a most elaborate nature. The whole crane, and especially the jib was built to offer the least possible resistance to wind pressure.

The crane is capable of lifting a load of 250 tons at a radius of 113 feet; 200 tons at 130 feet; and 100 tons at 175 feet. The electric locomotive crane, that travels a distance of 300 feet on the top of the cantilever, is able to lift 20 tons at a radius of 33 feet, and 10 tons at 60 feet so that the total radius for a 10-ton load is not less than 240 feet.

Control

The whole machinery with exception of the slewing gear is arranged in a house placed in the tail end of the cantilever. Two Ward Leonard motor generating sets of 95 horsepower are provided. With this system of control the whole of the regulation is effected by varying the excitation of the generators, the motors being permanently excited. As the

*With Demag, Duisburg, Germany.

Fig. 1.—250-Ton Hammerhead Crane at Blohm and Voss Shipyard, Hamburg, Germany

circuit for exciting the field amounts to only 3 percent of the main circuit, very small controllers are required.

The position of the controller handle exactly corresponds to a given speed of the motors. As it can be easily moved through a fairly large angle, a most accurate graduation of speeds is obtained so that the slightest movements can be made with ease and exactness, particularly when fitting machines or engine parts.

For ordinary working purposes one set is used for lifting, the other for luffing. Provisions are made that both motors can be switched to one set so that the work may be continued in case one set should get out of order.

Hoisting Mechanism

The hoisting motors drive two friction drums round which the hoisting rope is wound as well as the luffing gear. The slack end of the rope is taken up by a compensating block moving vertically on the rear of the bell structure. By the use of a change-speed gear smaller loads can be lifted at a greater speed. Two brakes are fitted, one electro mechanical brake the other a mechanical brake which is worked by the operator and which might serve as an emergency brake.

The lifting speeds are 5.25 feet per minute for the full load of 250 tons; 6.5 feet for loads below 200 tons; and as much as 13 feet for loads below 100 tons. The lowering speeds are 50 percent higher.

For luffing the jib a pinion on the motor shaft is thrown in gear which drives through bevel and spur gear reductions two large horizontal spindles situated on the top of the cantilever. These spindles traverse a nut carriage that is connected to the top flanges of the main jib by means of connecting rods. The luffing gear is designed so that the jib can be raised in 30 minutes with no load, and within 40 to 50 minutes with a load of 110 tons.

To avoid overloading of the crane structure the controlling devices of the main trolley and the locomotive crane are electrically blocked so that only one crane can work at a time. The main trolley can thus be only operated while the jib crane is standing in its extreme position on the tail-end of the cantilever where it acts as additional counterweight.

One Man Operates Entire Crane

Only one man is required to operate the whole crane. From his cabin below the fulcrum of the jib he is able to observe the work. Indicating devices, that are placed in the cabin, show him the exact position of the load even if the load is out of sight.

The locomotive crane is a self-contained crane with its own controlling devices and a separate controller for operating the slewing gear of the main jib.

Cranes of these dimensions have a large working area which can be doubled by placing them on a pier so that ships on both sides of the pier can be fitted out. The working area, though considerably increased over that of the old type cranes, can naturally be only a limited one. An almost unlimited area can only be covered by using a floating crane as it can be moved along the ship wherever required, obviating the necessity of moving the vessel at its moorings.

Floating Cranes

Floating cranes were first built as shears placed on a pontoon. A new type was introduced by the Demag, Duisburg, who built this crane for Swan, Hunter & Wigham Richardson's shipyard. To increase the reach a bent jib was employed which allowed the crane to lie close to the ship. With the increasing size of ships, the jib had to be mounted on a pedestal or tower of sufficient height to enable the jib to clear the deck superstructures. A crane of this type was first built for the Russian government for its Baltic shipyard, and has been subsequently furnished

to the Société Anonyme des Forges et Chantiers de la Méditerrane la Seyne, Toulon, France, to the Thames Iron Works, London, to Wilton's Engineering Works Shipyards, Rotterdam, and to the Russian Shipbuilding Company of Nikolajeff. They were built for putting on board ship complete boilers, turbines, pivots for gun turrets and for armoring battleships and have given much satisfaction. The crane represented in Fig. 3 has a capacity of 200 tons. The pontoon is built of steel and angles and is about 100 feet long and 78 feet wide. It is divided into a number of watertight compartments by longitudinal and transverse bulkheads. The stability of the crane is maintained even if two adjacent compartments become filled with water.

On this pontoon is built a steel frame work tower about 36 feet high. The jib which is provided with a derricking motion is built on the top platform of this tower. It derricks round the front portion of its base on two trunnions. The rear legs of the jib are secured by connecting rods fixed to a travelling nut carriage which travels vertically against the rear face of the tower. This carriage is traversed by two large vertical screws which are made to revolve together, for actuating the crosshead by a 110 horsepower steam engine, placed on deck. The angle formed by the front face of the jib and the extension of the platform can be varied from 30 to 85 degrees, a range which corresponds to a travel of the jib head of about 35 feet. Two sets of 100-ton tackle blocks are provided and also a 5-ton runner and a 20-ton block fixed to the end of the jib.

For lifting a 200-ton load, an equalizer is placed between the two 100-ton hooks. The main hook is arranged to float on a ball bearing facilitating the revolving of the load if required. The hauling ropes are wound round two drums fitted on deck and driven simultaneously or separately at

Fig. 2.—250-Ton Hammerhead Crane With Raised Jib

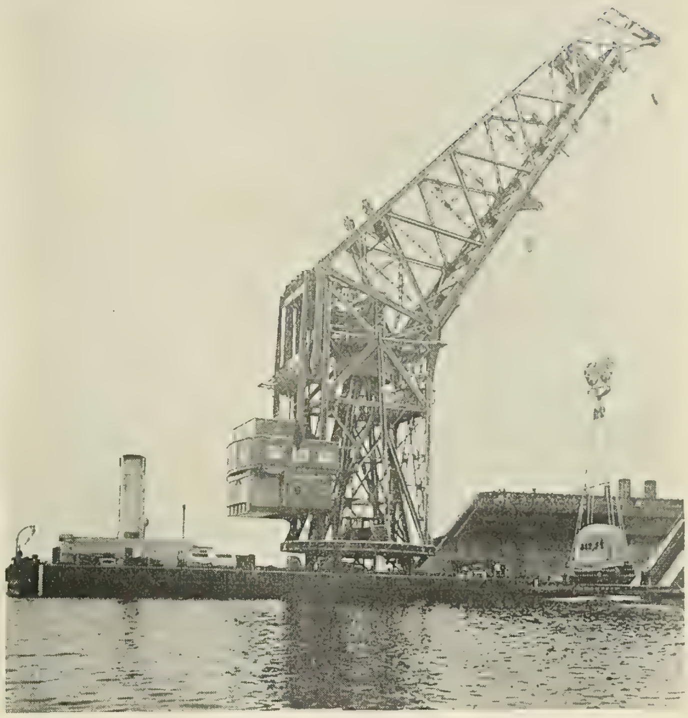


Fig. 3.—Floating Crane Handling 312-Ton Test Load

will by a 110 horsepower engine similar to the one for extending and pulling up the jib.

The 5-ton runner which travels along the front beams of the jib can be made to occupy any position along the jib.

The pontoon is provided with a compartment for taking water ballast with the object of limiting the inclination of the crane when heavy loads have to be lifted. Two steam winches are used for towing purposes.

A still later floating crane developed by the Demag is electrically operated, the jib being mounted on a bell shaped structure capable of revolving through 360 degrees on a tall pyramidical steel tower.

The full working load of 250 tons can be lifted to a height of 180 feet above the water level with an outreach beyond the pontoon fender of not less than 60 feet. With any load up to 50 tons the height of lift is 150 feet at an outreach of 138 feet, beyond the pontoon. Dealing with normal lifts, excepting turbines and boilers, this crane may lie on the offside of the ship, lift a load from the wharf, the jib reaching over the ship, and deposit it in the ship at any point desired.

For lifting there are two 95 horsepower motors with series parallel control. These motors are utilized for rotating the two large screws used in luffing the jib. As the luffing and hoisting gear may be coupled together, it is possible to move the load approximately horizontal while derricking.

The electric current for these motors is generated by two turbo-generators on board the pontoon so that the crane can be used at any point in the yard and is independent of a land electric station. Only one man is required to operate the crane.

In this crane there are no movable counterweights, nor is water ballast employed. The necessary stability with all loads and all positions of the jib depends wholly on the dimensions of the pontoon. This allows the operator to fix his attention entirely on the handling of the load, eliminating the possibility of capsizing through neglecting to tend to movable counterweights.

The pontoon is propelled by twin screws driven by steam engines each of 500 horsepower. A small electric lighting plant is installed on board which makes working at night possible by the aid of powerful searchlights.

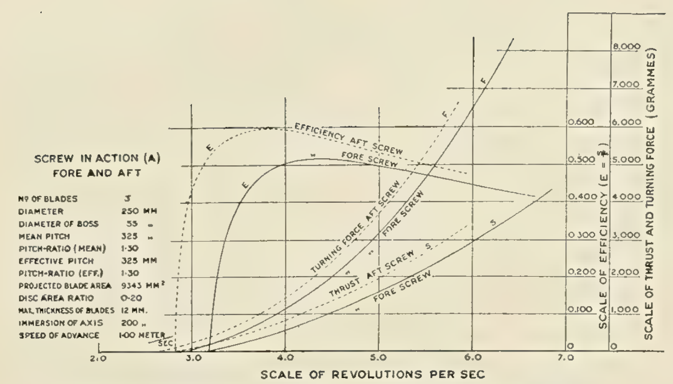


Fig. 1.—Curves of Thrust, Turning-Force and Efficiency.

Co-axial, Contrary-turning { Fore Screw (A). Aft Screw (A).

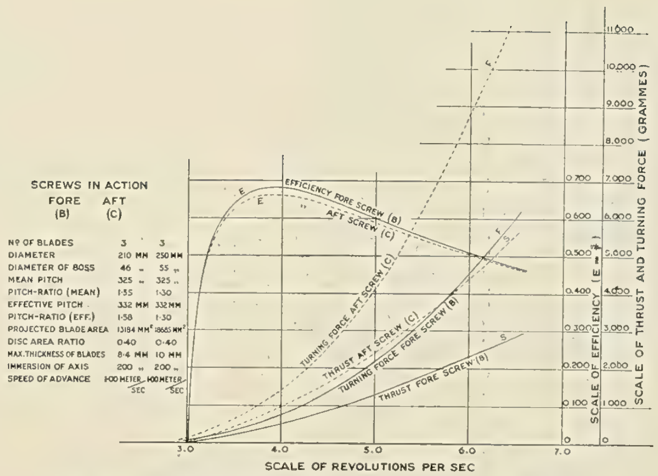


Fig. 3.—Curves of Thrust, Turning-Force and Efficiency.

Co-axial { Fore Screw (B) Aft Screw (C) } Contrary-turning.

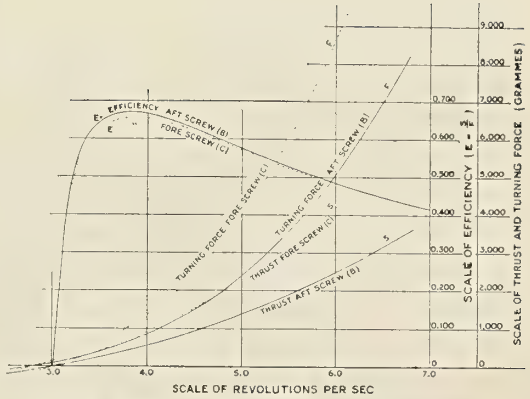


Fig. 5.—Curves of Thrust, Turning-Force and Efficiency.

Co-axial { Fore Screw (C) Aft Screw (B) } Contrary-turning.

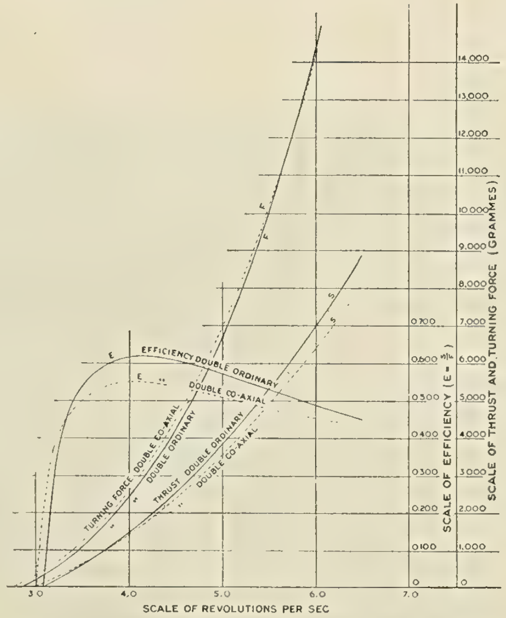


Fig. 2.—Curves of Thrust, Turning-Force and Efficiency.

Double Ordinary Screw (A).
Double Contrary-turning Co-axial (A).

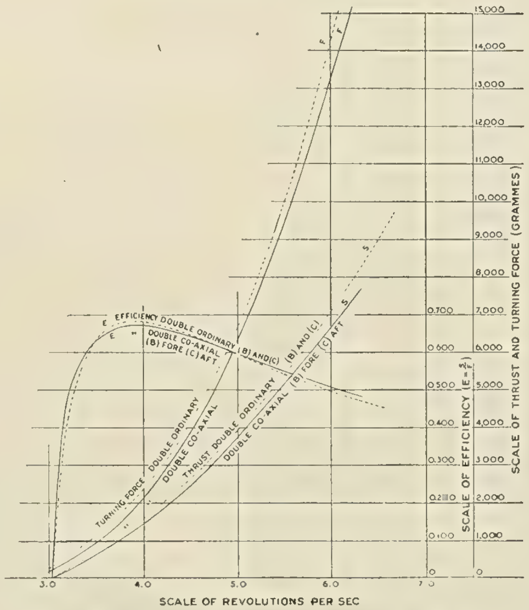


Fig. 4.—Curves of Thrust, Turning-Force and Efficiency.

Hypothetical Double Ordinary (B) and (C), Double Co-axial Screws (B) Fore and (C) Aft, Contrary-turning.

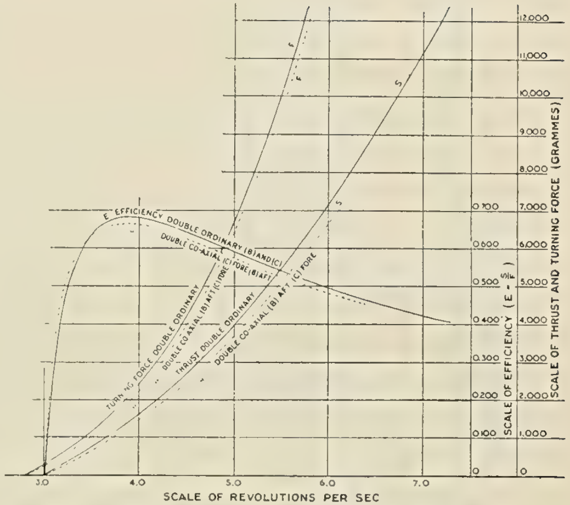


Fig. 6.—Curves of Thrust, Turning-Force and Efficiency.

Hypothetical Double Ordinary (B) and (C).
Double Co-axial Contrary-turning { (C) Fore. (B) Aft.

Further Experiments on Contrary-Turning Co-Axial Screw Propellers*

By General G. Rota†

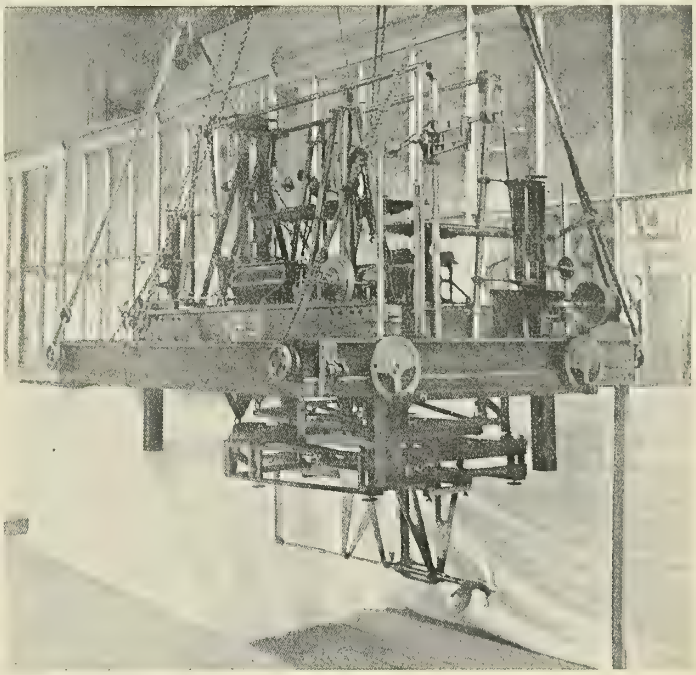
SHIP propulsion by means of double co-axial contrary-turning screw propellers has long been a matter of research. More than once results of experimental work have been presented before this Institution, and have given rise to interesting discussions.

In 1909 I had the honor of submitting the results of some experiments made in the Royal Dockyard of Castellamare di Stabia on a steam launch, whose single propeller had been replaced by two co-axial contrary-turning screw propellers. The same steam engine which drove the single propeller was employed to drive by gears the double propellers. The experiments showed that practically the same speed was obtained in both systems, with the same indicated horsepower, so that the work lost in the gear transmission was evidently regained through a better efficiency in the propellers. I rated this gain to be about 20 percent but whatever be the real amount of this figure, one thing came out as stated, viz. that the total efficiency of double contrary-turning screw propellers was higher than that obtained by a single propeller. Still better results could be obtained, as compared with ordinary twin screws, if the gain due to the lesser resistance of the hull, and to the absence of brackets, shafts and bossings, had been taken into consideration.

Mr. Luke, in his interesting paper presented to this Institution in 1914,†† brought a valuable contribution to this question, pointing out the value of hull efficiency elements under various conditions, viz. with a single screw, with twin screw propellers on parallel axes, with double contrary-turning co-axial screw propellers (combination), with double co-axial similar-turning screw propellers (tandem), etc. Considering the arrangement of propellers in which I am now interested, viz. with contrary-turning co-axial propellers, the particulars of Mr. Luke's experiences pointed to the conclusion that if a real gain in hull efficiency was obtained in full-bodied ships, but less in fine-formed ships, on the other hand, the propulsive efficiency proper for the screw was far less than that obtained with the single screw or ordinary twin screws, in the ratio of about 86 percent; so that there was practically the same total propulsive efficiency with fine-formed ships, and superior only by 7 percent with the co-axial contrary-turning screw propellers associated with full-bodied ships as compared with the single screw. These results did not agree with the results I obtained from my first experiments, and this induced me to undertake new experimental researches into this question.

In my first experiments with screw models, which I reported briefly in a written discussion on Mr. Luke's paper above mentioned (and I am inclined to think in those also of Mr. Luke and of other experimenters), the propulsive figures of each of the two contrary-turning co-axial screw propellers were not measured separately, so that it was always the value of the thrust given by the two screws and the total value of the efficiency of both which were obtained.

Wishing to know exactly what are in every case the peculiarities of the efficiency of each of the two screws acting together while contrary-turning, we have succeeded in the Experimental Tank at Spezia in modifying the general arrangement of the apparatus for the experiments with model screws, so that we can now measure the thrust and turning force of each screw either separately or in combination. It is not possible here to give a description of that apparatus, but it is shown in the photograph.



Apparatus Used at Spezia Tank for Testing Model Contrary-Turning Co-Axial Screw Propellers

The analysis of the performances of each screw enables us to investigate the influence of diameter, pitch-ratio, disk-area ratio and revolutions of the same, with the object of obtaining a higher efficiency, because, as is well known, this can only be attained by experiment.

In this paper, therefore, I give the results of some researches made with that apparatus with the sole object of adding a small contribution towards the solution of model experiment problems.

*Paper read at the Paris summer meetings of the sixty-third session of the Institution of Naval Architects, July 6, 1922.

†Royal Italian Navy.

††"Further Experiments Upon Wake and Thrust Deduction," Transactions of Institution of Naval Architects. Volume XLI, page 33.

"BEHIND" EXPERIMENTS (I.E. SCREW REVOLVING BEHIND THE MODEL)

		Full Model				Fine Model			
Screws in Action	Propeller Efficiency, E	Wake, $\frac{v - v_1}{v_1}$	Thrust Deduction $1 - \frac{R}{S}$	Hull Efficiency, $e = \frac{v}{v_1} . \frac{R}{S}$	Propulsive Efficiency, $E . e$	Wake	Thrust Deduction	Hull Efficiency	Propulsive Efficiency
Single	0.56	0.34	0.17	1.11	0 62	0.22	0.16	1.02	0.57
Double ordinary	0.56	0.20	0.15	1.02	0.57	0.13	0.13	0.98	0.55
Double contrary-turning co-axial	0.49	0.61	0.17	1.34	0.66	0.33	0.12	1.17	0.57

Several sets of experiments were carried out with this apparatus, adopting different kinds of screws, and I shall describe the principal features of some of them. Symmetrical screws (type A) of 250 millimeters diameter, 325 millimeters pitch, and a disk-area ratio of 20 percent, have given results which almost agree with those given by Mr. Luke.

In Fig. 1 are given the thrust, turning-force and efficiency curves as obtained with these co-axial screws. The difference between the two efficiency curves is considerable. The one corresponding to the fore propeller is much below the efficiency curve of the after propeller.

In Fig. 2 are given the thrust, turning-force and efficiency curves resulting from experiments with the same propellers (A) fitted on parallel shafts as in the ordinary twin-screw arrangement; the same are compared with the thrust turning-force and efficiency curves relating to contrary-turning screws on a common axis; the thrust and turning-force being the sum of the same relating to the individual propeller, and the efficiency is the total efficiency of the propelling system. From this comparison it appears that co-axial screw propeller efficiency for the model A is inferior to that of the single screw or the twin screws of same shape acting on parallel axes to an extent which agrees sufficiently with Mr. Luke's deductions; the efficiency of the double co-axial, for the case considered, being about 88 percent as compared with the same value for the ordinary twin-screw arrangement. With other combinations of screw propellers, however, the results were very different, so that it is possible not only to have a higher value of the ratio mentioned above, but also to have practically equal efficiency.

Further experiments were made with other screw propeller arrangements to investigate the influence of a less diameter for the fore propeller than for the after one and vice versa, keeping a constant pitch and increasing the disk-area ratio as compared with the experiments previously mentioned. In a first combination (see Figs. 3 and 4), the fore propeller (B) had

diameter = 210 millimeters
pitch = 325 millimeters
disk-area ratio = 0.40

and the aft propeller (C) had

diameter = 250 millimeters
pitch = 325 millimeters
disk-area ratio = 0.40

In a second combination the propellers were interchanged (see Figs. 5 and 6). The results were very interesting; the total efficiency of the co-axial screw propellers was practically the same in both combinations, and may also be considered to be the same as with equal open single or double ordinary screw propellers.

Total Propulsive Efficiency Increased

In view of the previous considerations, a good screw propeller efficiency can be obtained either with the two co-axial contrary-turning screws or with the single or with ordinary twin screws; so that the total propulsive efficiency, which, as is well known, is the product of screw propeller efficiency multiplied by hull efficiency, for the double contrary-turning screw propellers will have all the beneficial influence of the high hull efficiency of the same combination compared with the corresponding figure for single and ordinary twin-screw arrangements, as was stated in the interesting communication made by Mr. Luke.

Mr. Luke's investigations showed in fact that with the double contrary-turning screw propellers on a common axis the hull efficiency was 1.34 to 1.17, according to the fineness of the hull, instead of 1.02 to 0.98 as in ordinary twin-screw arrangements, and in the same ratio in the whole will remain at least the corresponding value of total propulsive efficiency. I am inclined to think that by the use of double contrary-turning screw propellers, and with the arrangements which experience may suggest, one will obtain a great improvement in the total propulsive efficiency—not less than 20 percent—even without taking into account the gain which may easily be foreseen by reason of the reduced resistance of the hull itself as a consequence of the suppression of brackets, bossings, etc.

Other special devices to increase the ship propulsion efficiency are already in use: the well-known fixed guide-blades used in Sir John Thornycroft's screw turbine propellers were shaped with a contrary curvature, as compared with revolving screw blades, so as to direct the water into a straight line aft and thus utilize the rotational component of the wake. Herr Wagner's counter-propeller is a similar contrivance designed to direct in a straight line aft the helicoidal motion of the wake. These experiments, and also the applications made with those devices, have shown, in various degrees, the possibility of increasing a ship's propulsive efficiency, but I am not aware of any advantage having been gained by adopting any of the above devices in order to improve the total efficiency, viz. screw efficiency and hull efficiency.

The double contrary-turning co-axial screw propellers would give, in my opinion, still better results, considering the contribution offered to the whole thrust by fixed guideblades or a fixed counter-propeller in a second propeller.

The arrangement of double co-axial contrary-turning screw propellers should therefore be considered with great attention by designers in cases where the difficulties connected with the arrangement of two co-axial shafts do not appear impossible of solution. Such a case is that of cargo boats with very full hulls when the propelling machinery is far aft. There is also a possibility of utilizing this system in submarines.

Machinery Arrangements

It is not possible here to enter into details of the alternative machinery arrangements in mercantile cargo boats, i.e. whether steam turbines should be utilized to drive both shafts, or a combination arrangement with a reciprocating steam-engine on the inner shaft and a steam turbine on the outer shaft, or whether electric motors should be provided on both shafts.

Other arrangements could be devised with steam turbines and reduction gears.

The double contrary-turning co-axial screw propellers would be, perhaps, suitable in submersible craft with the object of obtaining the simultaneous motion of both motors, electric and Diesel, for eventually increasing the speed on the surface. The advantages should be considerable; for example, a submersible with electric motors able to give a speed of 9 knots submerged and with Diesel motors, 12 knots surface speed. If it were possible to have all the motors acting at the same time, by adopting the co-axial contrary-turning screw propeller system, the surface speed could probably be increased to 15 knots, and perhaps a little more.

Under ordinary circumstances only one screw is in action, the other revolves idle, and so increases the resistance as to require a higher thrust; but considering all aspects of the problem, it should be possible to ensure conditions such as to reduce and perhaps overcome the above difficulty.

Before concluding I desire to express my gratitude to Captain A. Farina, of the Royal Italian Naval Construction Corps, for his valuable assistance in conducting the experimental work in the Tank at Spezia, where he is now in charge.

Export Markets for Marine Engine.—An analysis of foreign markets by the Acting Chief of the Automotive Division, Department of Commerce, shows that Latin America offers excellent prospects for the sale of American motor boats and marine engines, while in the Far East a most remunerative market for motors can be developed.

Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

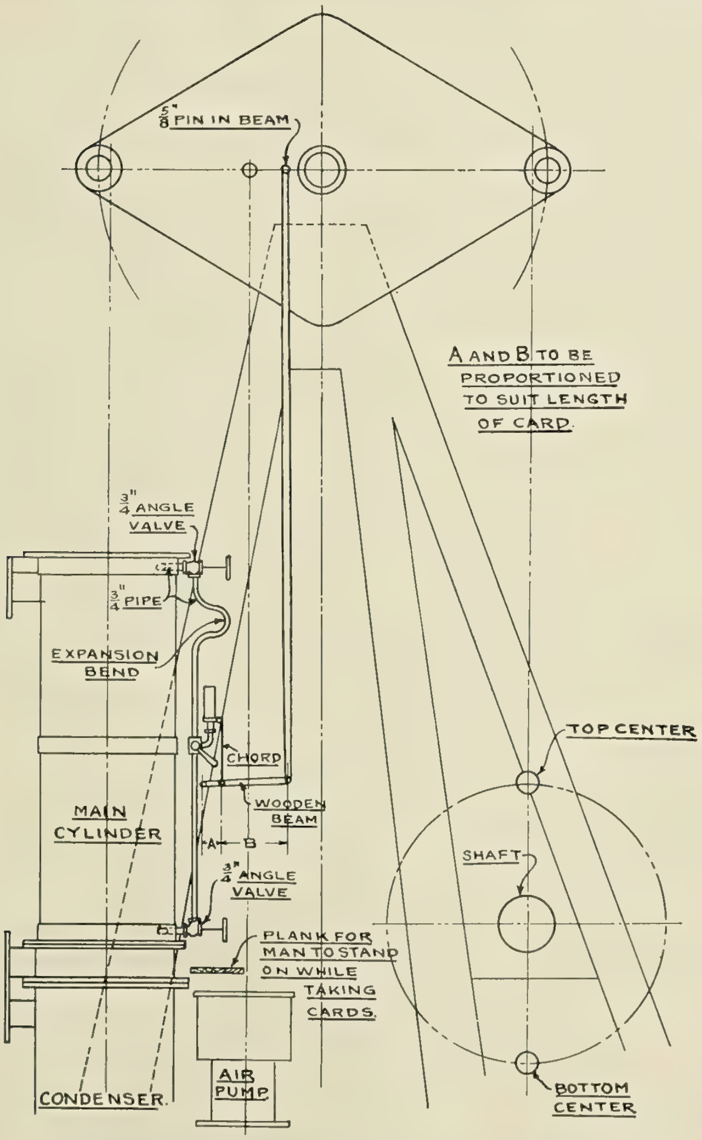
Indicator Cards from a Beam Engine

Q. (1164).—Please advise me how to connect a steam indicator to a beam engine for taking set of cards from same. The engine is on an inside wheel double end ferry steamer and has a cylinder 58 inches diameter and 10-foot stroke, the steam pressure allowed on the boiler is 50 pounds per square inch.

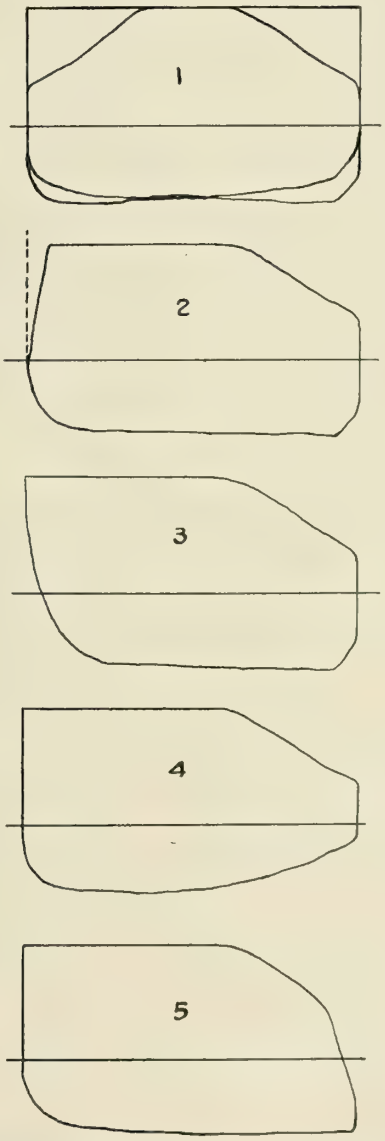
There are no connections on the cylinder, or any other part of engine, for connecting the indicator or cord of same. I can put the cocks in the cylinder, but I want to know where to connect the cord to the engine.

Please sketch set of cards, as they should look, taken from this engine, also sketch sets with too early and too late steam admissions and exhaust opening.

A. (1164).—If, as you say, there are no connections on the cylinder, it will be necessary before rigging up to indicate to have the upper and lower parts of the cylinder bored and tapped to take the usual piping for the indicator. These tappings should be drilled so that they open into the clearance between the top of the piston and under side of cylinder cover when the crank is on bottom center and the under side of piston and bottom of cylinder when the crank is on top center. This piping should be not less than ¾ inch and should have a valve top and bottom with the usual three-way cock to take the indicator, at some convenient place, preferably about halfway between the upper and lower connections.



Method of Taking Indicator Cards from Beam Engine



Sample Cards Taken from Beam Engine

In the upper part of this piping a bend should be made to take care of the expansion.

The reducing gear can be of any pattern. In a number of cases the writer has used a reducing gear along the following lines: A small pin about ⅝ inch diameter is located in the beam as near as possible to the beam center to suit conditions and from this pin a light link is run down to a small beam which can have its center fastened to any convenient stationary part of the engine. The engine frame is generally the best place for this purpose. This beam and link can be made of wood (ash will do) as wood is light and inexpensive. It will be necessary to arrange the leverage of the beam to get the required length of card.

Acknowledgment is herewith made to the W. & A. Fletcher Company, Hoboken, N. J., for the above reply to your question with its accompanying sketch.

Referring to the cards shown:

1. Valves properly set.
2. Late admission.
3. Early admission.
4. Late exhaust.
5. Early exhaust.

Comparison of Boilers

Q. (1166).—Will you please let me have some information regarding the efficiency, power developed, cost of installation and durability of Scotch marine, straight tube, bent tube, watertube and externally fired return tubular boilers such as are used in stationary plants, assuming similar conditions as nearly as possible in each case. Also similar information for coal and oil fuel.—F. V. G.

A. (1166).—From a careful reading of your question it would appear that a discussion in considerable detail of the power, cost of installation, durability, etc., of the several forms of Scotch boiler in comparison with the watertube and all other recognized forms of boiler would be necessary in order to properly answer your question. You will readily appreciate the fact that any such exhaustive handling of the subject is entirely without the province of this Department. It is believed that information, such as you desire, can only be obtained by a thorough study of boiler design and operation in each of the fields in which the several types referred to are in use. Even after such a study has been made, it is considered doubtful whether the comparison "assuming similar conditions as nearly as possible" would be practicable as each type is presumably fitted for operation under certain conditions and would be at disadvantage, if otherwise operated.

LETTERS TO THE EDITOR

Effective Simplification Must Consider Operator's Standpoint

I have read with interest the article by Mr. N. C. Wiley in the August issue of Marine Engineering and Shipping Age, "Simplification—Has it a Place in Shipbuilding?"

It is, of course, agreed that simplification with resultant saving in time and money to both owner and shipbuilder is desirable, if, by so doing, a satisfactory job is obtained from the owner's or operator's standpoint. Mr. Wiley's article treats the subject entirely from the shipbuilder's or contractor's standpoint and fails to appreciate the subject from the operator's point of view.

The author's criticism of operators who maintain a technical staff to prepare plans and specifications giving a detailed description of the work, as well as to check the plans and certain important details of construction, is not justified. The specifications must be complete and definite, if the shipbuilder is to estimate intelligently the cost of the work. The operator is in an excellent position to know what has proven to be the most satisfactory under service conditions, and there is an increasing tendency among ship operators to have and maintain an adequate and efficient technical staff to collect data and incorporate the results in preparing specifications for new work. It is only persistent and careful attention to details of construction and operation that enables the operator successfully to meet competition. It is axiomatic that the time required to prepare complete specifications which will insure the proper performance by the shipyard of the work intended is very fruitful to both the operator and the shipbuilder. In practice, it has been found absolutely necessary to have complete specifications in order to secure a satisfactory job in accordance with the true intent of the specifications.

With reference to Mr. Wiley's statement that "The expense and folly of submitting detail plans for approval are not fully realized by the average operator," it is generally conceded that the quickest, best and most economical way in the long run is to work from plans which have been approved by the operator. Rarely, if ever, have the operators insisted on or attempted to "criticize and check the plans of every detail of construction * * *." The inference in the article to leave it to the yard does not work out well in practice.

The reference to the specifications on a "rush job" which required flanged copper pipe for steam heating system obviously refers to the recent reconditioning of the *President Polk* (ex-*Granite State*) at the Bethlehem Shipbuilding Corporation's Baltimore Dry Dock plant, is ill-advised. In this case, it should be remembered that much of this piping is run behind stateroom or public room sheathing or ceiling and that screwed pipe connections are not the best practice for this condition. The operator must constantly look ahead and avoid and reduce, wherever possible, maintainance and repair costs. Navy practice, even where pipes are exposed, advocates flanged copper pipe for all steam lines. Its many advantages are too well known to repeat here. The only disadvantage is its greater initial cost, but this is offset by the freedom from leaky joints and connections, the avoidance of which is so essential in the passenger ship services. Practically every big reconditioning job on passenger ships of recent date has specified flanged copper piping for steam heating systems; it may also be considered the standard practice of the International Mercantile Marine, United States Lines and other large passenger ship companies.

How can simpler specifications and less checking of detail plans result in increased effectiveness and decreased cost of inspection as noted in the article's summary? It must of necessity be just the contrary.

In treating a subject of this kind it is of prime importance to consider it also from the owner's or operator's viewpoint, for what is satisfactory to the operator will be satisfactory to the shipbuilders in the long run because without successful operation there will be little, if any, commercial building or extensive reconditioning in this country.

New York City. A. M. Youngquist.

Operators Should Pool Their Experience

Mr. Youngquist's statement that I treated the subject of simplification entirely from the builder's point of view is disappointing, as I had attempted not to, and had instanced several advantages to operators in addition to decreased first cost. In spite of "the excellent position" operators are in, they seldom agree in their requirements. Take at random the specifications of several companies in similar trades, and line up their requirements on rigging, piping, rail stanchions, etc. The writer has done this, much to his confusion. He has also seen prints of standard fittings which had already received signed approval from several operators returned

from other operators with a fillet increased here, a pin there, and so on. Standard plans or practices are not retained by builders which are usually rejected when proposed. Therefore, builders' standards, if brought together and fairly analyzed, would represent a broader "experience under service conditions" than any one operator possesses. That is what I suggested should be done. I also suggested that operators, with Mr. Hoover's aid, pool their experience and iron out their disagreements and contradictions, then let the builders know, for once and all, what they decide is wanted.

To propably 95 percent of the readers of MARINE ENGINEERING AND SHIPPING AGE, it was not obvious what ship I meant in my illustration on piping. The statement as to where the copper pipe is run on the *President Polk* should be amplified by adding the words "in third-class quarters," as that ship still has screwed pipe behind sheathing and ceiling in first-class quarters. Later and larger American passenger ships have screwed steam heat piping throughout. However, I did not condemn the change on its merits and specifically stated so. I am merely wondering which kind of pipe the next passenger ship I work on will have, and there is nothing to guide my guess.

Mr. Youngquist, in his last paragraph, appears to assign our shipbuilding difficulties to unsatisfactory quality rather than to excessive cost. It will be a new viewpoint to many, and one seldom appearing in the press.

Baltimore, Md. N. C. WILEY.

NEW BOOKS

STEAM TURBINES (Second edition, 1922). By William J. Goudie. Size, 6 by 9 inches. Illustrations, 329. Longmans, Green and Company, New York.

The second edition of this work, although carried out on the general scheme of the first edition, has been practically rewritten. On account of the rapid development of the geared marine turbine and the necessity of describing recent designs by the leading manufacturers, the work has been considerably enlarged.

The author appears to have had the viewpoint of students, designers and operators well in mind in compiling his book. The principles and methods of arriving at basic formulæ are clearly explained and illustrated by examples showing the methods of calculation. Although these calculations in many cases require the exercise of judgment in the selection of empirical coefficients, nevertheless the text is designed to be applied to given cases under arbitrarily assumed conditions.

Many of the designers and draftsmen, however, will take the principles and formulæ for granted or will decide from their own experience, having worked out a few of the formulæ, that the work is sound. They will, of course, modify some of the empirical coefficients to suit what their past experience has taught them and no doubt many of them will resolve to check the scaffolding upon which the text is built at their earliest opportunity.

The first portion of the text is devoted to detailed descriptions of the various turbines now on the market and this portion of the book should appeal to seagoing engineers and managers and foremen responsible for the erection of such machinery. They can easily get a good idea of the intricacies of the various designs from the sectional drawings which are profusely given.

From these drawings not only the inner working parts and their relation to each other can be discerned but also their relation to the complete installation. This is just what a number of the readers will want to know, and the book gives them a clear exposition of how the various turbines work, together with the whys and wherefores.

Much of the volume is strictly technical but there is considerable descriptive matter that can be read with comparative ease and, therefore, the volume should be a valuable addition to the library of both technical and practical men.

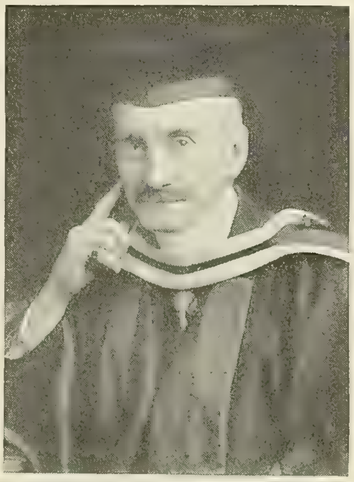
It should be noted that the work deals with the turbine proper only. As the author states, space is not available to take up the condensing plant or auxiliary machinery. Any matters relating to turbines, however, can be easily and quickly found by the aid of the comprehensive index.

PERSONAL MENTION

L. A. W. DOHERTY, general traffic manager of the Canada Steamship Lines of Montreal, has been made freight traffic manager of this company.

EDWARD P. FARLEY, of Chicago, vice-president in charge of sales of the Emergency Fleet Corporation, has resigned in order to return to private business.

DR. BRYSSON CUNNINGHAM, D.Sc., B.E., F.R.S.E., M. Inst. C. E., editor of the "Dock and Harbor Authority" and lecturer at the University of London on waterways, harbors and docks, will be in attendance this month at the annual convention of the American Association of Port Authorities at Toronto where he is scheduled to deliver an address on "Methods of Cargo Handling at British Ports." Dr. Cunningham has had an extended practical experience in dock and harbor engineering operations at various ports in Great Britain. For sixteen years he was assistant engineer in the service of the Mersey Docks and Harbor Board engaged on the construction of the Liverpool docks. In 1906 he became resident engineer with the London and India Docks Company and continued in this capacity upon the formation of the Port of London Authority. Late last year he left the service of the Port of London Authority in order to take up private practice in partnership with A. Havelock Case of Westminster.



Brysson Cunningham

J. BARSTOW SMULL, vice-president of the Emergency Fleet Corporation in charge of charters and allocations, has been elected president of the Corporation.

W. E. BURKE, in charge of the transportation department of the Canada Steamship Lines, has been appointed general traffic manager of this company with headquarters in Montreal.

COMMANDER F. P. BALDWIN, exclusive surveyor to the American Bureau of Shipping at Valparaiso, Chile, has resigned and will be succeeded by Alexander McBride, acting surveyor.

L. M. BRIMMER, formerly associate manager of the tank steamer department of the United States Shipping Board, has joined the staff of the Pierce Oil Corporation, 25 Broad street, New York.

W. J. Love, vice-president in charge of traffic of the Emergency Fleet Corporation, has been named vice-president and general manager.

H. S. Kimball, vice-president in charge of finance of the Emergency Fleet Corporation, has resigned. He will, however, act as fiscal agent of the Fleet Corporation in New York where negotiations are now being carried out for settlements with the pioneer purchasers.

H. Schreck was recently appointed chief engineer of the Diesel engine department of the Lombard Governor Company, Ashland, Mass. Mr. Schreck received his education at the Technische Hochschule of Berlin and obtained his early practical experience as a marine steam engineer. He has long been associated with the development and operation of Diesel engines having been for many years with one of the prominent shipyards in Germany in whose shops he superintended the manufacture of large Diesel marine units. While in Germany, he was active in the development of the first successful double acting two cycle marine Diesel engine which is still in service. After coming to this country Mr. Schreck entered the Diesel engine department of the Fulton Iron Works, St. Louis, Mo., as assistant chief engineer, later becoming chief engineer. Together with his new duties as chief engineer of the Lombard Company he will continue to act as consulting engineer to the naval architects, Messrs. Whittelsey and Whittelsey of New York.

H. Schreck

Clifton M. McBride, for two years assistant to the southern passenger manager of the International Mercantile Marine Company, has been appointed southern passenger manager to succeed Frederick T. DeCock, who has been transferred to the Baltimore office of the company.

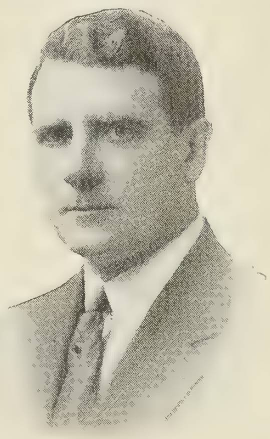
P. H. Lacy, formerly district director of the Shipping Board at Boston and later transferred to Savannah, has just been appointed district manager of the north Atlantic district which embraces all the ports between Montreal and Philadelphia. Mr. Lacy's headquarters will be at New York.

Sidney Henry, of Baltimore, director of sales of the Emergency Fleet Corporation, has been appointed to succeed Edward P. Farley as vice-president of the corporation in charge of sales. Mr. Henry graduated from the United States Naval Academy in 1901. After serving several years in the navy, he was appointed vice-president of the Baltimore Dry Docks and Shipbuilding Company, later assuming office with the Fleet Corporation.

Alfred H. Haag, marine superintendent for the Atlantic Gulf and Pacific Steamship Corporation of Baltimore, will this month become instructor of a new course in ship construction and operation which has been added to the curriculum of the Johns Hopkins University of Baltimore. Mr. Haag conducts a similar course in the George Washington University.

Calvin W. Rice, secretary of the American Society of Mechanical Engineers, has been appointed official delegate to the engineering congress to be held in connection with the International Exposition at Rio de Janeiro. For purposes of representation at the Congress Mr. Rice, who will act as emmissary of organized engineering in the United States, has been elected an honorary vice-president of the American Society of Mechanical Engineers. In addition to the American Society of Mechanical Engineers, Mr. Rice will represent at the Congress the Federated American Engineering Societies, the American Institute of Electrical Engineers, the Engineering Foundation, the John Fritz Medal Board, the Engineering Division of the National Research Council, the Engineers' Club of New York City and other organizations.

Joseph E. Sheedy, who has been acting vice-president of the Emergency Fleet Corporation in charge of operations, has been made vice-president of the Corporation. Mr. Sheedy has been connected with the shipping and shipbuilding industries since graduation from the Massachusetts Nautical Training School in 1903. He served as a commissioned officer in the Revenue Cutter Service for six years, resigning in 1901, when he became general superintendent with the Inter-Island Steam Navigation Company. He remained with this company for five years and then assumed the duties of assistant to the general manager of the Seattle Construction and Dry Dock Company. He has also been general manager of the Seattle North Pacific Shipbuilding Company; assistant to the president and general manager of the Downey Shipbuilding Company, and in September, 1921, European manager for the Emergency Fleet Corporation. He is a member of the Load Line Committee of the United States Department of Commerce and a member of leading naval and mechanical engineering societies in the United States.



Joseph E. Sheedy

OBITUARY

Francis S. Martin, consulting engineer and naval architect, died on July 27 at his home in Plainfield, N. J., after a two months' illness. He was born at Barrytown, N. Y., in 1852. Mr. Martin was graduated from the College of the City of New York, entered the shipyards of John Roach & Son, Chester, Del., and later was with Harlan & Hollingsworth Company, Wilmington. For the past forty years he has maintained in New York City an office for the surveying, designing, appraising and superintending the construction of ships of all classes. In 1917 Mr. Martin was appointed chairman of the Board of Survey and Consulting Engineers of the United States Shipping Board to take charge were put into American service. Mr. Martin was also for the Shipping Board one of the three members of The Ocean Advisory Board on Just Compensation. Throughout his many years as a marine surveyor, Mr. Martin has been instrumental in deciding many maritime litigations and in all these his position has been synonymous with fairness and justice. During all of his long business career and especially by his valuable services to the United States Government he attained an international reputation for faithfull service to all clients.

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

Bids to Be Taken This Month for Red "D" Ships; Three Types of Propulsion to Be Figured

Alternative Proposals Will Be Submitted for Reciprocating, Turbine and Diesel Engines—Principal Features of Machinery Specifications

BIDS were scheduled for receipt in September for the construction of two steel passenger and cargo ships for the Red "D" Line, which have been designed by Theodore E. Ferris, naval architect and marine engineer, of 30 Church Street, New York City. Proposals have been asked for ships propelled by reciprocating, turbine or Diesel engines.

The vessels will each have an over all length of 320 feet, will be of the two-deck shelter deck type, driven by twin screws and will be equipped to carry about 50 first class and 25 second class passengers. The ships will be built to American Bureau classification. Principal details regarding the proposed propulsion installations, for which prices have been asked, are as follows:

Reciprocating Engines

In the case of reciprocating engines, the machinery will consist of two return tube four-furnace, single-ended Scotch boilers about 16 feet inside diameter by 11 feet 8 inches long, fitted for burning oil, and two vertical, inverted direct acting, three-crank triple expansion engines with cylinders 18 by 29 by 47 inches diameter with 30-inch stroke. The engines are to be capable of making 120 revolutions and to develop a total of about 2,200 indicated horsepower.

The boilers are to be designed for a working pressure of 190 pounds per square inch.

The hull machinery will include a steam windlass, steam and hand steering gear, steam winches, warping winch and deck pumps.

There is to be one main condenser, cylindrical in shape and independent of the main engine, to contain about 3,400 square feet of condensing surface, the tubes to be seamless drawn ¾ inch.

There is to be located in the fireroom one vertical wet uptake starting boiler built for a working steam pressure of 190 pounds per square inch, the boiler to be about 3 feet inside diameter and 101 inches high, to have sufficient capacity for supplying steam to the fire pump and to run the oil fuel burning system. This boiler will be coal fired. The furnace fronts of each main boiler are to be arranged for burning oil fuel, interchangeable to coal burning, on the White, Dahl, Coen or other approved system.

Motorship Machinery

As motorships, the vessels will be driven by twin screws each propeller being driven by one six-cylinder four-cycle Diesel oil engine of the Polar type, manufactured by the McIntosh & Seymour Corporation, each engine being capable of developing 900 shaft horse-power making 140 revolutions per minute.

The auxiliaries in this case will be electrically driven and will comprise auxiliary engine, generator and compressor;

Each engine will be of the heavy duty marine type Diesel, with cylinders 22 inches in diameter and 32 inch stroke. They will be of the inclosed type with three stage compressors mounted on the forward end and driven from the crank shafts.

The auxiliary boiler to be located in the engine room will be of the vertical wet uptake or return tube type fitted with corrugated furnaces and having sufficient capacity to furnish steam at 150 pounds pressure. It will be oil fired and contain about 600 square feet of heating surface.

Turbine Propulsion

If turbine engines are decided upon the machinery will be a twin screw installation consisting of two independent sets of the latest design De Laval double reduction gear steam turbines and two cylindrical, return tube Scotch boilers, 16 feet 8 inches inside diameter by 11 feet long, the boilers being built for a working pressure of 185 pounds per square inch with 150 degrees of superheat and one starting boiler of the vertical wet uptake type, 3 feet inside diameter by about 101 inches high, built for 175 pounds per square inch working pressure.

Each turbine set will consist of one high pressure ahead and astern turbine unit driving a pinion through a double reduction gearing. The revolutions of the turbines at full speed ahead will be 4,000 per minute developing not less than 2,000 shaft horsepower and driving the propeller at 115 revolutions per minute.

The boilers will be arranged for burning oil fuel, interchangeable for coal burning, on the White, Dahl, Coen or other approved system and will also be fitted with the Howden's system of heated forced draft. Provisions are also made for the necessary auxiliary machinery, pumps, etc.

Main condensers will contain about 1,600 square feet of cooling surface and will be fitted with tubes ¾ inch outside diameter, the auxiliary condenser containing about 1,200 square feet of cooling surface with tubes ¾ inch outside diameter. There will be two 8-inch diameter main circulating pumps driven by vertical single-cylinder engines.

The two main boilers will be of the four furnace marine type.

Cleveland Yard to Build Another Steel Freighter

THE American Shipbuilding Corporation, of Cleveland, Ohio, has been awarded a contract by Pickands Maher & Company, of Cleveland, for the construction of a 600-foot steel cargo carrier for use on the Great Lakes.

The ship will have a deadweight tonnage of approximately 12,000, driven by a triple expansion reciprocating steam engine, and makes the fifth ship of this type contracted for in the Lake district so far this year. It is expected she will cost about $800,000.

Contract Placed with Federal Yard for Nine Boilers

THE contract for the construction of nine boilers has been awarded to the Federal Shipbuilding Company, of Kearny, N. J., by the Luckenbach Steamship Company. For what particular purpose the boilers are being constructed was not announced.

The boilers will be of the Scotch marine type, 17 feet 6 inches in diameter by 13 feet long and will be built for 225 pounds pressure. Each will have four 44-inch furnaces and will be oil burning, using forced draft. The boilers will be equipped with 2½-inch tubes and will have 4,380 square feet of heating surface. It is understood that they will be built at a total cost of approximately $170,000.

Single Screws, Motor Driven, for Two Munson Liners

IT is learned that the Munson Line, which was considering two alternative propositions with regard to the conversion to motorships of the steamships *Courtois* and *Covedale*, has decided to convert the vessels into single screw ships, the *Courtois* having arrived at the plant of the Sun Shipbuilding Company, Chester, Pa., during the past month.

The *Courtois* will be equipped with one of the two 900-brake horsepower McIntosh & Seymour oil engines purchased by the Munson Line from the Shipping Board. The engine is of the four-cycle six-cylinder type developing 140 revolutions and is expected to drive the ship at about 8 knots. A new Scotch auxiliary boiler having about 1,000 square feet of heating surface will be installed. The work will cost about $60,000.

Chairman Lasker Announces Changes In Shipping Board

A. D. LASKER, chairman of the United States Shipping Board, has made the following announcement of changes in the personnel of the Emergency Fleet Corporation:

H. S. Kimball, New York, vice-president in charge of finance, has resigned, to become effective at once. He will, however, act as fiscal agent of the Fleet Corporation in New York, where its largest accounts are located and where negotiations are now being carried out for settlements with the pioneer purchasers. He will be succeeded by his assistant, Col. Joseph W. McIntosh, Chicago, former chief of subsistance of the U. S. Army, who now becomes a trustee of the Fleet Corporation.

Edward P. Farley, Chicago, vice-president in charge of sales, has also resigned, to become effective at once. Mr. Farley, it is understood, is to return to private business. He will be succeeded by Sidney Henry, of Baltimore, now director of sales, who now becomes a trustee of the Fleet Corporation. Mr. Henry is a graduate of the Naval Academy, class of 1901.

Mr. Lasker stated that Vice-president J. Barstow Smull, in charge of charters and allocations, has been elected president of the Fleet Corporation, and W. J. Love, now vice-president in charge of traffic, has been named vice-president and general manager.

Referring to the reported severance of the connection of August F. Mack with the Fleet Corporation, as district manager of the New York district, Mr. Lasker stated that Mr. Mack had agreed to remain with the Fleet Corporation for an indeterminate period.

Diesel Passenger and Freighter Is Contracted For

THE contract for the construction of a motor driven combination freight and passenger vessel has been awarded to the Murnon Shipbuilding Company, of Mobile, Ala. The vessel will be 120 feet long, driven by two 120-horsepower Kahlenburg Diesel motors. The vessel was designed by Cox & Stevens, naval architects, New York City.

Sun Shipbuilding Company Is Lowest Bidder for Construction of Four Diesel Electric Dredges

Chester, Pa., Company's Prices Lead Field of Sixteen Bidders Including Four Navy Yards—All Seaboard Sections of Country Represented in Competition

WITH a price of $653,080 for one; $1,300,160 for two; $1,920,240 for three, and $2,528,240 for four, the Sun Shipbuilding Company, of Chester, Pa., submitted the lowest bid for the construction of seagoing Diesel-electric hopper dredges for the Government, at the opening of tenders by the Chief of Engineers, War Department, Washington, D. C., on August 2. The Boston Navy Yard submitted the second lowest bid with a price of $2,610,000 for four vessels, and the New York Navy Yard submitted the highest bid for the four vessels, at $3,631,708.

Sixteen tenders were submitted, including four navy yards. The bids are as follows:

Bidder	1 Dredge	2 Dredges	3 Dredges	4 Dredges
Sun Shipbuilding Co., Chester, Pa.	$653,080	$1,300,160	$1,920,240	$2,528,240
Boston Navy Yard, Boston, Mass.	......	......	......	2,610,000
Todd D. D. & Constr. Co., Tacoma, Wash.	750,000	1,433,000	2,107,000	2,676,000
Bethlehem Shipbldg. Corp., New York .	742,000	1,458,000	2,140,000	2,798,000
Merchant Shipbldg. Co., Chester, Pa. ..	799,000	1,499,000	2,159,000	2,799,000
Puget Sound Navy Yard	775,000	......	......	2,900,000
Newport News S. B. & D. D. Co.	......	1,532,000	2,255,000	2,976,000
Staten Island Shipbuilding Co.	783,000	1,519,000	2,250,000	2,980,000
Federal Shipbuilding Co.	861,999	1,617,104	2,335,290	3,033,648
Moore Shipbldg. Co., Oakland, Cal. ..	861,925	1,674,150	2,484,375	3,265,100
Bath Iron Works, Bath, Me.	963,000	1,818,000	2,672,000	3,527,000
New York Shipbldg. Corp., Camden, N. J.	978,500	1,835,000	2,691,000	3,547,000
Los Angeles S. B. & D. D. Co.	948,000	1,828,000	2,698,000	3,578,000
New York Navy Yard, Brooklyn, N. Y.	......	1,907,269	......	3,631,708
Mare Island Navy Yard	869,397	1,678,833	......	......
H. E. Crook Co., Inc., Baltimore, Md. ..	874,000	1,710,000	......	......

Charleston Yard Lowest Bidder for New Dredge Hull

THE Charleston Dry Dock & Shipbuilding Company, Inc., of New Orleans, with a price of $25,850, submitted the lowest tender for the construction of a steel dipper dredge hull for the United States District Engineer Office, Montgomery, Ala. Proposals were opened at 11 a.m., on July 31, the bids submitted being as follows:

Charleston Dry Dock & Shipbuilding Co., Inc. (New Orleans)	$25,850
Tampa Shipbldg. & Engineering Co.	29,000
Charleston Dry Dock & Machine Co.	33,921
Milwaukee Bridge Co.	36,450

Coast Guard May Build New Ship; to Overhaul Seminole

THE construction of a new Coast Guard cutter and the reconditioning of one of this type of vessel now in service is in contemplation by the United States Coast Guard Service, at Washington, D. C. Whether or not a new construction contract will be placed this fall depends upon the action of Congress on the bill recently introduced for the construction of a new cutter to replace the *Bear*.

The Coast Guard Service also expects to place the cutter *Seminole* out of commission this fall for the purpose of reconditioning and general overhauling before she assumes duty on a new station to be determined later.

Reboilering and Reconditioning of Coast Guard Cutter Gresham Goes to Staten Island Shipbuilding Co.

THE Staten Island Shipbuilding Company has been awarded the contract for reboilering and reconditioning of the United States Coast Guard cutter *Gresham*, following the recent opening of bids at Washington, D. C.

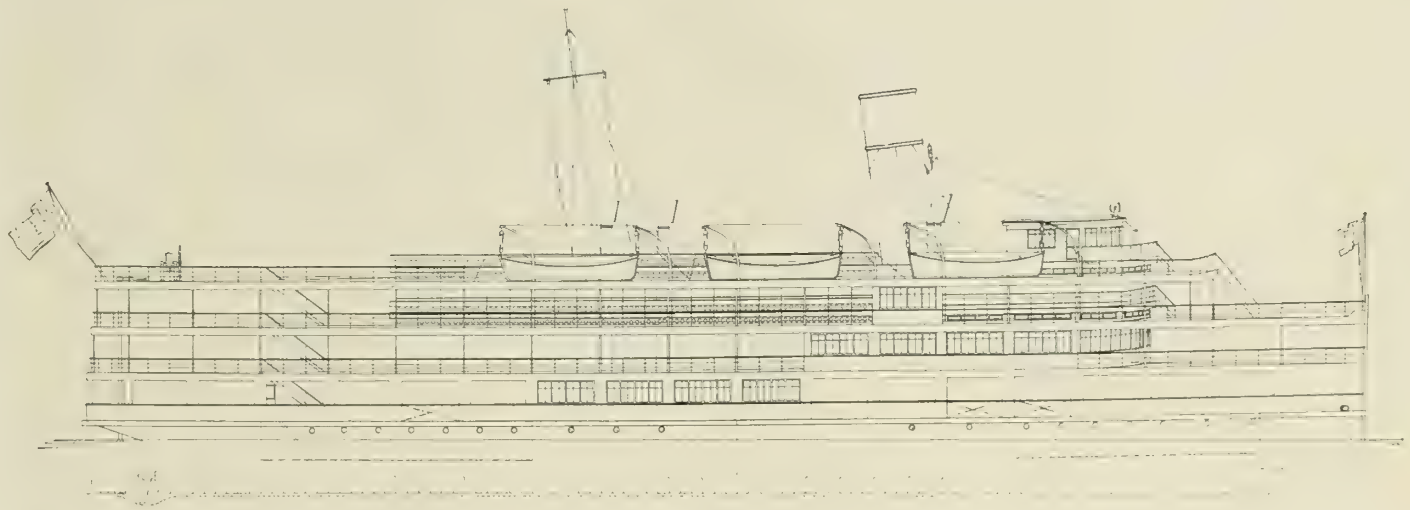
Three proposals were submitted, Bid No. 1 dealing with items of work directly related to converting the *Gresham* into an oil burning vessel; Bid No. 2, hull repairs such as outside plating and work upon which no lump sum bid could be expected; and Bid No. 3, items not necessarily related to the conversion of the vessel to burn oil. The prices submitted were as follows:

List of Bidders	Bid No. 1	Bid No. 2	Bid No. 3
Newport News	$60,705	15	$44,730
Todd Shipbuilding Corp.	68,350	25	29,500
Morse Dry Dock & Repair Co.......	75,670	22	37,350
Maryland Dry Dock	67,578	24	37,311
Staten Island Shipbuilding Co........	71,500	30	21,400
Bethlehem Shipbuilding Co...........	81,847	25	36,953
Sun Shipbuilding Co.	85,080	20	41,065
Federal Shipbuilding Co.	92,890	20	21,984
W. & A. Fletcher....................	85,000	22	45,000

Fletcher Yard to Convert Carfloat Into a Hospital

THE W. & A. Fletcher Company, Hoboken, N. J., has been awarded the contract for the conversion of a car float into a floating hospital for the Auxiliary of the Tubercular Division of Bellevue Hospital, which is under the direction of Dr. James Alexander Miller. Plans and specifications for the work were prepared by the firm of Cox & Stevens, naval architects, New York City, who will also have supervision of the conversion.

The vessel is 240 feet in length with 60 feet beam, upon which a two-story structure, to have in it wards, recreation rooms, etc., will be built. The contract, which involves about $40,000, is scheduled for completion early in the fall.



Outboard Profile of New Day Steamer, Designed by George Sharp, New York Naval Architect, for Wilson Line.

Pusey & Jones Low Bidder for Construction of 3,000-Passenger Steamer for Use on Delaware River

George Sharp, New York Naval Architect, Designs Vessel With New Features for Wilson Line—Ship Will Be 220 Feet in Length, Built of Steel and Steam Driven

THE Pusey & Jones Company, of Wilmington, Del., with a total price of $529,000 for two day passenger steamers driven by reciprocating engines and $599,000 for the same steamers if driven by turbine engines, submitted the lowest bids for new vessels for the Wilson line, of Wilmington and Philadelphia, at the opening of tenders on August 17. The bids were received by George G. Sharp Company, naval architects and consulting engineers, 30 Church street, New York City, who designed the vessel.

The proposed vessel is designed to carry 3,000 passengers. She will be a single screw steamer equipped with triple expansion steam engines and watertube boilers, to develop a speed of 18 statute miles and will have a length of about 220′ 0″. The vessel will be built of steel throughout with three complete passenger decks and shade or boat deck.

The men's smoking room, ladies' cabin and lavatories will be situated on the main deck, along with luncheon counter, and on the saloon deck there will be a large open air ball-room 84 feet long by 36 feet wide without obstruction of any kind except bandstand. Forward of the dancing space on this deck, there will be a large observation and refreshment room extending the full width of the vessel. The remainder of the deck forward and aft and at sides of dancing space will be available for passengers.

Above the saloon deck is the observation deck, which is entirely open. One of the features for the comfort of passengers is that this deck is terraced at three levels giving unobstructed vision to all passengers, the levels of the shade deck being arranged in a similar manner and the space between the different levels being open permits of the free circulation overhead of air and light to the passengers on the observation deck.

Federal Yard Is Awarded Standard Oil Repair Job

THE Federal Shipbuilding Company, of Kearny, N. J., has been awarded the contract for repairs to the steamship *S. B. Hunt*, of the Standard Oil Company of New Jersey, following the opening of bids on August 9.

Alderton Company Is Low Bidder for Invincible Repairs

THE Alderton Dry Dock Company submitted the low bid for the work of general overhauling of hull and engines on the electric-drive ship *Invincible*, at the opening of tenders by the Shipping Board, at 45 Broadway, New York, on August 8.

Staten Island Co. Gets Repair Job on Steamer Suboatco

THE Staten Island Shipbuilding Company, with a price of $13,590 and 10 days' time, was awarded the contract for repairs to the freight steamer *Suboatco*, of the Transmarine Corporation, following the opening of bids by that company at 5 Nassau Street, New York, on August 8.

Tietjen and Lang Yard Awarded Oil Conversion Contracts

THE steamships *Medina*, of the Mallory Line and the *Pawnee*, of the Clyde Line, are at the Tietjen & Lang plant of the Todd Shipyards Corporation, Hoboken, New Jersey, for conversion from coal to oil burning.

Bids to Be Asked This Fall for Two Clyde Line Ships

INFORMATION obtained recently by MARINE ENGINEERING AND SHIPPING AGE leads to the belief that bids will probably be asked early in the fall for the construction of two coastwise passenger and freight ships for the Clyde Line.

Unofficial estimates placed the probable cost of these vessels at about $1,500,000 each. Theodore E. Ferris, naval architect and marine engineer, of 30 Church Street, New York City, has begun the work of preparing tentative plans and specifications for these proposed vessels although it is not thought likely that they will be put out for bids before October.

It is understood that the new ships will be about 425 feet in length, of the same general type as the Clyde Line steamship *Lenape*, with larger and more extensive passenger accommodations and greater speed. Propulsion will probably be by turbine engines and the new ships will replace the steamships *Apache* and the *Arapahoe*.

Aero Alarm Co. Gets Installation on S. S. Leviathan

THE Aero Alarm Company, Inc., of Seattle, Washington, through its New York office, has been awarded the contract by the Newport News Shipbuilding Company for installation of the Aero alarm system on the steamship *Leviathan*, now undergoing reconditioning at Newport News, Va. The company is also making additions to the Aero alarm system on the steamships *America* and *George Washington* and has contracted through its Los Angeles office to extend the system on the Admiral Line steamship *Ruth Alexander*.

Through its Los Angeles office, the same company has installed the Aero system on the steamships *Yale* and *Harvard*; will extend the Aero alarm system on the steamship *City of Los Angeles*, and through its Seattle office has been awarded the contract to extend the system on the steamships *President Madison* and *President Cleveland*.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Steamship Drydocked, Chester, Pa.—American steamship Argus was drydocked at Sun Shipyards for repairs.

Crowley Contracts, San Francisco, Calif.—Three sub-chasers and cutter Tulare were taken to Crowley yards for overhauling.

Propeller Fitted, Baltimore, Md.—Lighthouse tender Maple was hauled at Spedden's shipyard to be fitted with new bronze propeller.

Schooner Drydocked, Los Angeles, Calif.—Four-masted steam schooner Ella A. was drydocked for hull cleaning, painting and general repairs.

Steam Schooner Drydocked, San Francisco, Calif.—Steam schooner Fort Bragg was drydocked on ways of the Barnes & Tibbitts dock to undergo overhauling.

Repairs to Lighthouse Tender, Norfolk, Va.—Lighthouse tender Orchid went to yard of Norfolk Shipbuilding and Dry Dock Company for docking and repairs.

Contract Awarded, Brooklyn, N. Y.—Morse Dry Dock and Repair Company was awarded contract for overhauling and reconditioning the steamship City of Alton.

Tanker Drydocked, San Francisco, Calif.—British tanker El Grillo went to Bethlehem yards to be drydocked for cleaning and painting and to have tailshaft drawn.

Steamer Overhauled, West Coast.—U. S. Quartermaster steamer Captain Anton Springer went to Georgetown shipyard to undergo general overhauling.

Launching of Ship, Wilmington, Del.—The first of two ships, contracted for by Pusey & Jones for the Seaboard-Bay Line, was launched July 25. The ship will be the State of Maryland.

Contract Awarded, Wilmington, Del.—Pusey & Jones Shipbuilding Company was awarded contract to construct a steel floating grain elevator, 100 feet long, for the Pennsylvania Railroad.

Contract Awarded, Kearny, N. J.—Federal Shipbuilding Company was awarded contract for repairs to the steamship S. B. Hunt, of the Standard Oil Company of New Jersey. Price $15,738.

Temporary Repairs, San Pedro, Calif.—Crowell & Thurlow freighter William A. McKenney, damaged in collision, went to Los Angeles Shipbuilding and Dry Dock Corporation for temporary repairs.

Reboilering and Reconditioning, Staten Island, New York.—Staten Island Shipbuilding Company was awarded contract for reboilering and reconditioning United States Coast Guard cutter Gresham.

Bids for Two Clyde Line Ships.—Bids will probably be asked early in the fall for construction of two coastwise passenger and freight ships, 425 feet long, for Clyde Line. Approximate cost, $1,500,000 each.

Steamship Conversion, Brooklyn, N. Y.—Steamship Comus, of the Southern Pacific Steamship Company, went to the plant of Robins Dry Dock & Repair Company to be converted from coal to oil burner.

Steamer Repairs, Staten Island, N. Y.—Staten Island Shipbuilding Company, with price of $13,950 and 10 days' time, was awarded contract for repairs to freight steamer Suboatco, of the Transmarine Corporation.

Newport Shipbuilding Contracts, Newport News, Va.—Plant of Newport News Shipbuilding & Dry Dock Company repaired steamship Deepwater, from Constantinople, schooner Moonlight and steamers Cowan and Comparle.

Robins Shipyard Awarded Repairs, Brooklyn, N. Y.—Robins Dry Dock & Repair Company, of the Todd Shipyards Corporation, was awarded contract for repairs to the British steamship Andree. Price $45,850. Time 24 days.

Conversion to Motorships, Chester, Pa.—Steamships Covedale and Courtois, recently purchased by Munson Line from Shipping Board, were awarded to Sun Shipbuilding Company for work of conversion to motorships.

Turbine Engine Overhauling, Seattle, Wash.—Shipping Board awarded contract to Todd Drydocks Corporation plant at Harbor Island, Washington, for purpose of having her turbine engines completely overhauled.

Conversion to Oil Burner, Mobile, Ala.—Steamer Osage, of Moore & McCormack fleet, is to be changed from a coal burner to an oil burner and generally reconditioned by Todd Shipyards Corporation, at cost of $60,000.

Steel Hull for Steamer, Jeffersonville, Ind.—Howard Shipyards, of Jeffersonville, Ind., was awarded contract for construction of a steel hull for the excursion steamer East St. Louis, to be placed during the winter.

Dredge Repair Contract, Oakland, Calif.—The Hanlon Dry Dock & Shipbuilding Company was awarded contract by United States Engineer for repairing two 20-inch pipe line dredges and auxiliary floating plant. Price $2,176.

Trial Trip, Poughkeepsie, N. Y.—The official trial trip of the new ferryboat Poughkeepsie took place from the foot of Main street, Poughkeepsie, N. Y. The boat will go into service for the Poughkeepsie and Highland Ferry Company.

Contract Awarded, Oakland, Calif.—Shell Oil Company awarded contract to Union Construction Company for a 4,000-barrel oil barge costing $175,000. Barge to be used for bay transportation. She will probably be completed in September.

Fireboat, New Orleans, La.—The Johnson Iron Works, Dry Dock & Shipbuilding Company, Inc., was awarded contract for construction of steel screw fireboat for city of New Orleans. Price $264,447, boat to be completed in 220 days.

Annual Inspection, San Francisco, Calif.—Captain Andrew Dixson's yacht and the lumber carrier Brooklyn of Sudden & Christenson, went to Barnes & Tibbets yards, the latter vessel to undergo annual overhauling, drydocking and inspection.

Contract Award, Newport News, Va.—The Newport News Shipbuilding & Dry Dock Company was awarded contract for construction of two combination passenger steamers for Ocean Steamship Company, of Savannah. Price $920,000 each ship.

Contracts on West Coast.—New tanker F. H. Hillman of the Standard Oil Company, went on drydock at Hunter's Point for minor adjustments and the Casco of Swayne & Hoyt's fleet went on No. 3 drydock of the Bethlehem Shipbuilding Company.

Repairs and Inspection, Johnson Dry Docks.—The Cuban steamers Ramon Miramon and Edourdo Sala, recently purchased by D. Sullivan and Company, of Chicago, for operation on the Great Lakes, underwent repairs and inspection by government steamboat inspectors at the Johnson Docks.

Conversion to Cableship, Seattle, Wash.—War Department contract for converting steamship Dellwood into a cableship went to Todd Dry Docks, Incorporated, of Seattle. The Dellwood is one of 8,800-ton cargo steamers built for the Shipping Board during the war. Amount of expenditure involved is $200,000.

Conversion Contracts, Hoboken, N. J.—Tietjen & Lang, of Todd Shipyards Corporation, were awarded contract for reconditioning steamships Medina, of the Mallory Line, and Pawnee, of the Clyde Line, from coal to oil burners. Approximate cost, $100,000. The yard also installed Best oil burning system in New York Central tug No. 18.

Steel Freighter, Cleveland, O.—The American Shipbuilding Corporation, of Cleveland, Ohio, was awarded contract by Pickands, Maher & Company, of Cleveland, for construction of a 600-foot steel cargo carrier for use on Great Lakes. Deadweight tonnage about 12,000, driven by triple expansion reciprocating steam engine. Probable cost, $800,000.

Carfloat Conversion, Hoboken, N. J.—W. & A. Fletcher Company, Hoboken, N. J., was awarded contract for conversion of car float into a floating hospital. Plans and specifications prepared by Cox & Stevens, naval architects, New York City. Vessel is 240 feet long, 60 feet beam. Two-story structure, to have wards, recreation rooms, etc. Price about $40,000.

Construction of Tugs, Brooklyn, N. Y.—Orders for construction of three steel single screw tugboats for the New York Central were placed with the Tebo plant, of the Todd Shipyards Corporation. Delivery expected end of January, 1923. Boats to be oil burning equipped with Todd merchanical oil burners. Over all length 108 feet, beam 25 feet 6 inches, molded depth 12 feet 9 inches.

Construction Contract, Mobile, Ala.—Contract for the construction of a motor-driven combination freight and passenger vessel was awarded to the Murmon Shipbuilding Company, of Mobile, Ala. Vessel will be 120 feet long, driven by two 120 horsepower Kahlenburg Diesel motors. Designed by Cox & Stevens, naval architects, New York City. Scheduled for delivery in November.

Work at Union Iron Works, San Francisco.—Ferryboat San Mateo, constructed by Union Iron Works for Six-Minute Ferry Company, went on drydock for minor adjustments. Contract was awarded the Union Iron Works for repairs to the Matson liner Wilhelmina, damaged in collision with steamer Maui. More than 110 feet of deck rail on the starboard side, as well as stanchions, were to be replaced.

Shipyard Activities, West Coast.—Freighter Grace Dollar went on Hunter's Point Drydock to have tail shaft drawn and undergo general repairs. Tanker William F. Herrin and steamer Northland went to Union Iron Works drydocks for cleaning, painting and general overhauling, and steam schooner Claremont of Hart-Wood Lumber Company went to Alameda plant of the Bethlehem yards to undergo hull repairs.

New York Harbor Work.—A Munson Line tug was awarded to the New York Harbor Dry Dock Company for completion, the work including installation of oil engines, bulkheads and tanks, putting on of superstructure, etc., at a total cost of close to $12,000. The vessel will be used in Cuban waters. The shipyard was also awarded the job of reconditioning the Shipping Board steamer West Elcasco at a price of $7,835.

Refrigeration Space on Steamship, Chester, Pa.—Sun Shipbuilding Company, of Chester, Pa., was awarded contract to insulate and convert steamship San Lorenzo, of the New York and Porto Rico Steamship Company, into an air-cooled freight carrier. Brunswick Refrigerating Company's machinery will be used and ship will have about 120,000 cubic feet of cargo space. Price submitted $138,768; time 60 running days.

To Build New Tug, West Coast.—David W. Dickie, naval architect, completed specifications for new tow boat to be built for Coos Bay Lumber Company. Tug was designed for towing purposes and will contain a 165 horsepower engine, with a hull fifty-seven feet long and sixteen-foot beam. Vessel will have a very large engine room and be controlled from the pilot house. Craft will cost about $30,000 and will be used to tow log rafts from Oakland harbor to Bay Point.

Conversion Into Single Screw Ships.—Munson Line will convert steamers Courtois and Covedale into single screw ships. Courtois went to Sun Shipbuilding Company, Chester, Pa., to be equipped with one of the two 900-brake horsepower McIntosh & Seymour oil engines purchased from the Shipping Board. New Scotch auxiliary boiler having about 1,000 square feet of heating surface will be installed. Work to cost about $60,000.

Contract Awarded, San Francisco, Calif.—Standard Oil Company has awarded contract to the Bethlehem's California yard for the construction of a tank vessel of 12,000 barrels' capacity. The boat is to be finished by December. It will be equipped with an electric drive from two generators driven by two Werkspoor Diesel engines. The new ship is to have a length of 230 feet, beam 40 feet, depth 16 feet 6 inches and a speed of 10 knots. She will trade up and down the Pacific Coast.

Repair Contracts, Hoboken, N. J.—Steamship Cour d'Alene, of the Bull Line, went to W. & A. Fletcher Company's yard to be drydocked, have stem taken out and straightened, replaced, crumpled plates made good and fore peak tanks proved tight. The yard was also awarded Bull Line steamship Ellenor for repairs, steamship Elizabeth of the same line for general repairs, Shipping Board steamship Lavada, steamship Mount Carroll of the United American Line and the Standard Oil barge Socony No. 86.

Steamer Wanted, Ecuador.—An Ecuadorean firm is inquiring in southern marine circles to ascertain if they can purchase a new or second-hand oil burning steamer with accommodation for between thirty and forty passengers in the first class, fifteen to twenty-five in the second class and with cargo space for about 150 head of cattle and at the same time capable of maintaining a speed of ten to sixteen knots. Vessel will probably be placed in trade between Ecuador and the Galapagos Islands. The name of the intending purchaser or further details may be secured from Mr. George H. McCloud, United States Department of Commerce, Bureau of Foreign and Domestic Commerce, Room 214 Custom House, New Orleans, La.

SHIPYARDS AND DRY DOCKS

Corporation to Enlarge Plant, Staten Island, N. Y.—New York Harbor Dry Dock Corporation plans to install an additional 10,000-ton dock at its plant in Rosebank, Staten Island, adjoining the twelve new piers just completed by the City of New York. To provide additional berthing space required, an additional tying-up pier will also be constructed. The corporation has purchased the two 10,000-ton drydocks previously leased from the Shipping Board. One and three-quarter million dollars of new money has been put into the enterprise and a larger corporation has been formed. When shipping conditions improve, the new company anticipates increase in its repair work of both American-owned ships and foreign ships.

Dry Dock Company to Move Plant, Mobile, Ala.—Alabama Dry Dock and Shipbuilding Company will transfer all of its operations to Pinto Island, moving all of its big machinery of the machine shop, plate shop and other departments now located on the west side of Mobile river to the island where the large dry docks of the firm are located. R. D. Dunlap, president of the company, announced that the entire plant will be located on the east side of the river. At the Pinto department the Alabama firm has its large 10,000 ton sectional dry dock, its large Pinto dock and several smaller dry docks. With the removal of all departments to the Pinto site, the company will better be able to take care of its big repair jobs. The Alabama firm will keep only one department on the west side of the river. The small cradle ways at this department, used in hauling out sailing vessels and small steam craft, will be the only part of the big ship repair and dry docking concern to be left on that side. Considerable money will be spent in the erection of new buildings and installing machinery at the Pinto Island plant, according to a statement by Mr. Dunlap.

PORT IMPROVEMENTS

Seawall, Aransas Pass, Tex.—Attorney General's Department, Austin, approved $213,000 bond issue for seawall. Address Mayor.

Harbor Contract Planned, Norfolk, Va.—Three hundred thousand dollars each has been allotted for improvement of Thimble Shoal Channel and Norfolk Harbor.

Wharfing Facilities, Seattle, Wash.—Ames Shipbuilding & Dry Dock Company has been granted permission to extend the present wharfing facilities at their site 509 feet, work to be started at once, it is understood.

Contract Award, Portland, Me.—Directors of Port of Portland, 67 Commercial street, awarded contract for construction of north and south sheds and grain conveyor gallery, State Pier, Contract 10, to M. A. Long Company, 1523 Munsey Building, Baltimore, Md.

Dredging, Brooklyn, N. Y.—Superintendent of Public Works, Albany, N. Y., awarded contract to Taylor Dredging Company, Communipaw Ave., Jersey City, N. J., for dredging portion of Henry Street Slip at Gowanus Bay, Terminal Contract 90. Price $19,085.

Seawall, Annapolis, Md.—Specification 4621.—Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded contract for constructing a seawall at Naval Academy to McLean Contracting Company, Fidelity Building, Baltimore, Md. Price $14,350 (120 days).

Contract Awarded, Chicago, Ill.—Great Lakes Dredge & Dock Company, 104 South Michigan avenue, Chicago, Ill., was awarded contract by Harbor & Dock Commissioner, of Troy, N. Y., for constructing dock wall, also improving and regulating river and dock front at Troy. Price $582,795.

Contract Awarded, Brooklyn, N. Y.—J. H. Delaney, Commissioner of Docks, Pier "A," North River, New York, awarded contract to Riverside Contracting Company, 164 Montague street, for building ramp and dumping board at foot of West 23d street, Coney Island Creek, and completing dredging.

Pier Contract Placed, Norfolk, Va.—J. T. Nuchols Company, Richmond, Va., was awarded contract for rebuilding Chesapeake & Ohio pier and warehouse, burned at Norfolk, several months ago. Amount of contract not made public, believed to be not less than $125,000. New pier and warehouse will be of fireproof, constructed of reinforced concrete and steel, 450 by 52 feet, approximately, and will more than compensate for space lost when original structure burned.

Port Developments and Improvements, Texas.—A total appropriation of $1,571,000 has been authorized by the Rivers and Harbors Commission for the development and maintenance of Texas ports. The appropriation includes $750,000 for completion of the Houston ship channel, $240,000 for maintenance work on Galveston harbor and channel, $100,000 on Texas City harbor and channel, $20,000 for Port Bolivar, $300,000 for Beaumont, Port Arthur and Orange, $61,000 for Caddo Lake dam and $100,000 for other projects.

New Orleans Improvements.—Projects on the city front under way, authorized by the dock board or for which plans have been completed call for an expenditure of $2,200,000, according to Mr. Walsh, general manager. By the end of the year this entire project will be in full swing. Meanwhile plans are to be drawn for other improvements on the city front, the financing for which was provided by the dock board last December, shortly after the board was reorganized under the new state law. The work at the four wharves mentioned will require expenditure of $1,500,000. Plans have been approved for reconstructing the Seventh Street landing, building a shed, and rat-proofing the wharf, at a cost of $250,000. The Robin street shed is to be rat-proofed and widened, sheds added at Celeste and Market streets, and the latter wharves also rat-proofed, in addition to the raising of the levee.

NEW INCORPORATIONS

Harlem Navigation Company, capital $140,000, chartered in Delaware.

The Braeger Shipping Company, of Manhattan, capital $100,000, chartered at Albany, to do business as export freight contractors and brokers. F. Braeger, W. Proksch and A. Begg, incorporators.

The United States Trade Line Company, capital $1,000,000, chartered under Delaware laws to operate boats. New York Register & Transfer Company, attorneys.

Norma Steamship Corporation, capital $150,000, chartered under Delaware laws. Incorporators: Alva F. Wallander, H. Victor Crawford, and George C. Sprague. Mr. Crawford and Mr. Sprague, lawyers, with offices at 120 Broadway, New York City.

FOREIGN ACTIVITIES

New Vessel, Scotland.—Tenders have been called for among Clyde shipbuilders by a shipowning company who are in the market for a 12,000-ton ship.

Doxford Vessel Launched, England.—Messrs. William Doxford and Sons, Ltd., Sunderland, launched another of the Doxford standard vessels for the Moor Line, Ltd., managed by Messrs. Walter Runciman and Company, Ltd. Dimensions, 450 feet by 54 feet by 37 feet; closed shelter deck type, 10,800 tons on 28¼ feet draft; 12 knots trial speed. Vessel was named Castlemoor.

Exceeds Contract Speed, Canada.—New Canadian Pacific turbine steamer Empress of Canada, recently built on the Clyde by Fairfield Shipbuilding and Engineering Company at cost of over two millions sterling, completed her first trip across the Pacific without a hitch. She averaged 19.75 knots, engines developing 21,000 horsepower and passed previous record on the eastbound trip across the Pacific by 8½ hours.

Conversion of German Warship.—The Ægir, recently placed in commission, was converted to motor cargo-carrying ship. Last year the Odin was similarly made over and has been engaged in conveying locomotive and other material from Germany to Russia. The decks of the Ægir were cut out and steam machinery was replaced by two Benz-Diesel engines, each 350 horsepower. The vessel can carry twelve locomotives and tenders, former being placed on removable rails on deck.

Contract for Three New Vessels, England.—The United Fruit Company has placed contracts for the construction of three large passenger and cargo steamers, to ply between the Caribbean and Boston, with Cammell, Laird & Co., Ltd., of Birkenhead, England. The ships are to be finished in about a year. They will be 325 feet long, 48 feet breadth of beam and 31.9 feet depth of hold; equipped with four 750-horsepower Diesel electric engines. The British Thompson, Houston Company, an associate company of the General Electric, will furnish the electric drive.

Steel Screw Hopper Barge, England.—Steel screw hopper barge No. 18, first of three vessels which the Monmouth Shipbuilding Company, Ltd., Chepstow, are building for Port of London Authority, was launched recently. Vessel is of single-deck type, with raised forecastle and large hopper placed amidships for carrying dredgings. Dimensions are: Length between perpendiculars 215 feet, breadth molded 35 feet 6 inches, depth molded 19 feet 3 inches, mean draft 16 feet. Propelling machinery consists of one set of triple expansion surface condensing engines, capable of propelling vessel at speed of 10 knots.

Tanker Launched, England.—Sir W. G. Armstrong, Whitworth and Company, Ltd., launched from their Armstrong yard the steel screw tanker Amsterdam, built to order of American Petroleum Company, Rotterdam. Principal dimensions of vessel are: Length overall 455 feet, length between perpendiculars 440 feet, breadth extreme 57 feet 6 inches, depth molded to upper deck 33 feet 11 inches. She will be fitted with triple expansion machinery, steam being supplied by three boilers working at 180 pounds pressure and capable of propelling the vessel, when loaded with 10,450 tons, at speed of about 11 knots on mean draught of 26 feet 3 inches.

German Shipbuilding Figures.—Since the beginning of March, 1922, 19 large steamers representing a total of more than 100,000 tons have been launched from German shipyards for account of German navigation companies. Since the same date the Germans have purchased abroad about 35,000 tons. The amount of steamers actually under construction at German yards represent a total of more than 300,000 tons. The tonnage built in the year 1920 was about 500,000, exceeding by about 40,000 tons the total construction of the year 1913. The present productive capacity of the German shipbuilding yards is estimated to be at least 700,000 tons per annum.

STEAMSHIP INTERESTS

The shipping department of the Hugo Stinnes interests plans to open in October a new line from Hamburg to Singapore, Shanghai and Yokohama.

A. Miller McDougal, shipbuilder, has announced plans to establish next spring a refrigerator and package service with a fleet of modern freighters plying between Duluth and the Atlantic.

At the request of Portland shippers, the Shipping Board has allocated three additional vessels to the Columbia Pacific Shipping Company for Trans-Pacific service. This will give the concern two sailings a month to the Orient from Portland.

With the sailing of the *City of Los Angeles* from Los Angeles on September 9, the Los Angeles Steamship Company will inaugurate a passenger and freight service to Honolulu. The *City of Los Angeles* drydocked at Los Angeles Shipbuilding Company to undergo reconditioning. Upon the arrival of the *City of Honolulu*, from New York, at Los Angeles, the ship went into the same yards to be overhauled. The *City of Honolulu* will sail on September 23, according to present schedule.

The yacht *Cynthia*, designed by Cox and Stevens and built by the Todd Shipyards Corporation, passed successful trials. The vessel is a twin screw, Diesel engined yacht, 129 feet over all in length, 26 feet beam, 6 feet 6 inches draft. Her main propelling machinery consists of two Diesel type six-cylinder four-cycle Winton engines, each developing 225 brake horsepower. She has a cruising radius of 4,000 miles and is designed for a speed of twelve knots. The yacht is owned by Commodore Merill B. Mills, of Detroit.

The United American Lines, managing agents for the American Hawaiian Steamship Company, have extended their service from the North Atlantic to the Pacific Coast to include the port of Baltimore and have inaugurated a new service to the Pacific Coast from Mobile and New Orleans. The Baltimore service is fortnightly and the Gulf service, monthly. These services are in addition to the weekly sailings already maintained by the company to the West Coast from New York, Boston and Philadelphia. The expansion of this service to include Baltimore, Mobile, and New Orleans, involves the addition of nine steamers. The United American Line opened a branch office at Baltimore in the Maryland Casualty Building on August 14.

BUSINESS NOTES

The Johns-Pratt Company, Hartford, Conn., manufacturers of Noark fuses and protective devices, Vulcabeston packing and insulation and Johns-Pratt molded products, announces the establishment of a New York office at 41 East 42nd Street, New York.

Scheid Engineering Corporation, 90 West Street, New York City, has been appointed metropolitan and export representative for the Franklin Moore Company, Winsted, Connecticut, manufacturers of Material Handling Machinery for industrial plants.

Announcement has been made of the consolidation of the Foamite Firefoam Company, with general offices at 151 Fifth Avenue, New York, and O. J. Childs Company, Inc., of Utica, N. Y., in a program uniting these important fire protection interests under a new and complete service organization. At a meeting of stockholders recently it was decided that the company will hereafter be known as "Foamite-Childs Corporation" and the following officers were elected: Mr. W. J. Childs, president of the Childs corporation, president; F. M. Watters, vice-president; E. Janeway, secretary; and F. J. Maginniss, treasurer. Mr. James C. Patterson will continue as a director in full charge of sales. There will be no change in the sales policies of the consolidating companies. The executive offices will be located at Utica, N. Y.

TRADE PUBLICATIONS

Towing Machinery.—A description, with photographs, drawings and technical data, is given in a bulletin by the American Engineering Company, dealing with its automatic steam towing machine. Detailed information on the operation of the machine is given.

Lewis Iron.—The Penn Iron & Steel Company, of Creighton, Pa., has issued an interesting booklet on the manufacture of iron and iron products. Considerable details are also given regarding the Lewis special staybolt iron, engine bolt iron, chain iron, drill staybolts and U. S. Navy iron. Tables are shown giving the weight per foot of round and square iron.

Standard Seamess Tubes.—In No. 1, of a series of brochures published by the Standard Seamless Tube Company, of Pittsburgh, Pa., the bloom was followed through various steps to finished chipped billets. The second bulletin, showing the tube mill operations including the piercing of steel billets, has been distributed and will be followed by a third issue showing the Cold Draw Department.

Metals Coating.—A series of photographic reproductions with descriptive matter has been published by the Metals Coating Company of America, Philadelphia, Pa., which present the adaptability of commercial requirements of the Schoop metal coating process. As a protection against high temperatures, it is set forth that, by spraying with aluminum, oxidization and scaling in grate bars and similar pieces is retarded and clinkers are prevented from adhering. It is also claimed that the Schoop metal spraying process can be successfully applied to distributors and automatic stokers, condenser tubes, pyrometer couple tubes, boiler tube cleaning equipment, valves, pistons, explosion chambers of internal combustion engines, etc.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—S. M. Robinson. U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City.
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

Marine Engineering and Shipping Age

Volume XXVII | October, 1922 | Number 10

OCT 9 - 1922 U. S. PATENT OFFICE

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
L. S. BLODGETT, Associate Editor W. Z. GARDNER, News Editor

Contributing Editors
Rear Admiral C. W. Dyson, U. S. N.
Captain C. A. McAllister, U.S.C.G. (Retired)
Commander S. M. Robinson, U. S. N.
Winthrop L. Marvin
William Gatewood
H. McL. Harding
William T. Donnelly
James L. Bates

WE GUARANTEE that of this issue, 5,250 copies were printed; that of these copies 3,878 were mailed to regular paid subscribers, 214 were provided for counter and news company sales, 237 were mailed to advertisers, 43 were mailed to employees and correspondents and 878 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 54,750—an average of 5,475 copies a month.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

Action Scheduled for November

THAT the shipping bill will come up for action in the House in November and in the Senate in December is the belief of the majority of the Congressmen. The opponents of the subsidy know full well that to delay action on this measure in the House until the short session, when that body's time will be fully occupied with appropriation bills, would delay consideration of the proposed shipping legislation until the next Congress which begins in March. In the meantime they hope that the elections in November will result in a depletion of the Administration's majority and that a sufficient number of new members who are opposed to Government aid to shipping will be obtained to kill the bill for good and all.

It is not reasonable to suppose, however, that the Administration after causing one of the most complete studies that has ever been attempted on any subject made by the very best experts on shipping, and after incorporating the facts and findings of these experts in the pending legislation and putting up the splendid fight for an American merchant marine that it has, will sit quietly by and allow the opponents of the bill to have their way without a struggle.

It is, therefore, with a great deal of satisfaction that we note a quotation of Representative Mondell, Republican floor leader in the House, in a bulletin of the National Merchant Marine Association which is as follows: "The shipping bill is not dead by any means. We will follow the President's suggestion and postpone action on it just for the present. I believe that it will be taken up in November and may even be passed before the December short session."

The subsidy opponents will also shortly find out that the American merchant marine has a good many staunch supporters among the Democrats. Note the way the National Merchant Marine Association, of which Senator Joseph E. Ransdell, a Democrat, is president, figure it out. "The President has agreed to a postponement until shortly after election, presumably until Monday, November 13, and the few weeks remaining between then and the opening of the December session will supply sufficient additional time for the shipping bill to make its passage practically assured. Under the House rules speedy action can easily be secured and the bill passed before the beginning of the December session, while the Senate will have probably about six weeks in which to act before the annual appropriation bills will have come through the House to the upper branch."

Bearing in mind the extraordinarily difficult industrial situation to which the President has been compelled to devote practically his whole time during the summer, it is a reasonable belief that he suggested the postponement of action to November in order that he might be free to champion to the limit the cause of American shipping. When the time for action arrives and the complex problems now confronting the Administration and the supporters of the subsidy bill are solved, then, the foreign shipping interests and their followers will learn that America is determined to support its merchant marine by the only comprehensive plan that has been advanced by our shipping experts.

American Marine Week

AMERICAN Marine Week, which will be celebrated at the Grand Central Palace, New York City, from November 4 to 11, will have a far reaching effect on the destiny of our merchant marine. The benefits that can be secured for American shipping through the cooperative and united action of the principal maritime organizations cannot be exaggerated. With the marine field acting as a unit, it is bound to have a strong influence on the passage of the pending shipping legislation and, with the widespread publicity that undoubtedly will be given to the papers and addresses, presented by prominent men at the various meetings, there cannot fail to be a revival of interest in our merchant marine in the public mind. When the

general public realizes that the prosperity of our country depends on shipping our surplus products to foreign markets the future of American vessels will be assured.

American Marine Week means much to the marine field in general but it will mean much more to every man who is fortunate enough to be able to attend. The Marine Exposition will be a brilliant display of everything that is new and interesting to the marine profession. Models of ships and inventions, full size specimens of equipment, fittings and the products that enter into the construction of vessels, naval exhibits, life saving devices and many other items may be examined and studied at close range. No one who desires to keep up to date can afford to miss such an opportunity.

In addition to this, professional men will have an opportunity to hear technical papers that will be read before the annual convention of the Society of Naval Architects and Marine Engineers. These papers and the discussion of them by members of the society are published all over the world. What an opportunity not only to hear the best that America can give to the science of naval architecture and marine engineering but also to see and make the acquaintance of the leading specialists in marine design!

But even this is not all, for at the convention of the American Marine Association addresses on maritime subjects will be delivered by prominent Government officials and leading members of the numerous organizations participating in American Marine Week. So it will be the privilege of those who attend the conventions to get a composite picture of the problems of the entire marine field and its allied industries.

Finally, one of the greatest reasons why every one who can possibly attend should do so is that the entire week offers opportunities for making acquaintances and meeting old friends. There is no other occasion during the whole year when the entire marine field gets together. The intimate business and social intercourse between shipowners, shipbuilders and manufacturers of marine equipment from all over the country is not only of great benefit to the industry as a whole but it is also of great personal advantage to every one who has the privilege of attending.

The Agamemnon and Mount Vernon

According to a newspaper interview with Commissioner Frederick I. Thompson of the Shipping Board on his recent arrival from Europe, that official will immediately recommend that the liners *Agamemnon* and *Mt. Vernon* be reconditioned and put into service. As an indication of the necessity of putting these ships in commission, Mr. Thompson reported that the *George Washington* could have taken 200 additional passengers on her return trip, if there had been room for them.

Officials of the United States Lines have made careful studies of the possibilities of these vessels and their estimates show that very favorable returns could be earned on the cost of their repair. The *George Washington* and *America* are making money and there is a growing sentiment both here and abroad in favor of traveling on the ships of the United States Lines. The *Leviathan* will be a great advertisement for our merchant marine and practically all Americans who travel to Europe will want to say that they made at least one trip on this famous vessel which, when completed, will be second to no ship afloat.

On the other hand what is to be done with the *Agamemnon* and *Mt. Vernon*, if they are not reconditioned? Are they to be allowed to rust away at their docks at Hoboken and Boston or are they to be sold to foreign interests who will recondition them and put them into competition with our own vessels? Is the *Leviathan* to be the only 23-knot liner in the American transatlantic service until new ships are built? Who is going to be responsible, if that vessel builds up a sort of one way express passenger service from which foreign lines receive from one-half to two-thirds of the benefit?

A Standard Bill of Lading

It is generally recognized that there is an urgent necessity for a clear codification of the rights and liabilities which arise between carriers and shippers upon bills of lading used for ocean shipments. The Hague Rules, 1921, which are the result of voluntary action and bargaining between vessel owners and shippers, were drawn up under the guidance of the International Law Association and they contain, in such terms that business men all over the world who are engaged in overseas trade can understand them, a set of rules that has received the endorsement of most foreign commercial organizations and the Chamber of Commerce of the United States.

To quote Mr. A. D. Mearns, chairman of the Liverpool Steamship Owners' Association: "I am satisfied that the drafting as it stands will serve in the 999 transactions of which the lawyers never hear. I should have thought that it would serve even in the one case out of the 1,000 that comes before the law courts, if the lawyers are only content to interpret the rules as they are understood by the traders and the shipowners, and to forget the thousands of cases that have been collected, discussed and criticised by Lord Justice Scrutton and Mr. Carver."

We are, therefore, glad to learn that the United States will send representatives to take part in a discussion of a revised form of the Hague Rules which will be under consideration by the Comite Maritime in London on October 9-11. The results of this consideration by the Comite Maritime will be brought before the International Maritime Conference which is to meet in Brussels the latter part of October. This conference has been called by the King of Belgium and the United States will be represented there by official delegates appointed by the President.

In order that the delegates from the United States might have the benefit of the views of all interested parties, the Shipping Board held public hearings in Washington on September 20-21 which were attended by representatives of shipowners, shippers and underwriters. The Shipping Board is to be commended on securing American representation at the coming International Conference and also for giving our delegates a line on the opinions of our business men through a public hearing. It will be noted from the article on page 643 that there is not an American signature on the recent report of the International Conference on Safety of Life at Sea.

The 1,000-Foot Ships

CHAIRMAN LASKER'S statement, that a $30,000,000 company has been projected which will construct two mammoth liners of 1,000 feet length and of 70,000 gross tons, providing the pending shipping legislation is passed, has caused considerable comment. Although Mr. Lasker asserted that the names of the members of this proposed company are household words, no publication, at this writing, has succeeded in obtaining anything but denials of participation from the prominent men who would be considered most likely to engage in a shipping venture. But, as it is inconceivable that Mr. Lasker would make such a statement without good reason to believe that these vessels would be actually built providing reasonable national protection is secured for our shipping, we can account for our lack of knowledge of who the principals really are by the fact that financial affairs are usually consummated before they are made public.

There is nothing new about a proposal to build vessels of 1,000 feet in length. It will be remembered that there was considerable publicity given to such a project about three years ago and at least the preliminary plans for two 1,000-foot liners were said to have been actually made by the Gibbs Brothers. Perhaps, if President Wilson had not requested the International Mercantile Marine Company not to dispose of its vessels flying the British flag to an English syndicate, these ships would have been under construction or completed today. Optimism prevailed in shipping circles in 1919. Prominent shipowners predicted that the shipyards would be busy for years and it was easier to obtain $200 a ton for a vessel then than it is to get $30 now.

Since then, however, the White Star Line and the Cunard Line have each placed three monster greyhounds on the North Atlantic service and these big ships are not only paying their own way but also making up any deficits of the smaller vessels. It is a fact that accommodations on the larger vessels are always in demand in spite of the excess fare and when a vessel is carrying between 1,000 and 1,200 first and second class passengers each way it is not difficult to believe even if we did not know that they are clearing as much as a quarter of a million dollars on each round trip.

Now as the great majority of first and second class passengers are American citizens, there is every reason to believe that American ships having equal or greater speed and luxurious appointments would secure their share of the trade and, if the Government, as it is proposed in the shipping bill, grants sufficient compensation to make up the difference in cost of construction and operation over that of foreign ships, what is there strange about America adopting the German policy of going their English rivals one better?

The shipping bill is framed to encourage the construction of vessels that are most needed not only from a commercial but also from a naval standpoint. The 1,000-foot ships would be a most important addition to our naval reserve and, for this reason alone, they ought and probably would be entitled to a maximum loan at 2 percent interest from the Construction Loan Fund, if their plans were approved. The subsidy for such vessels on account of speed and tonnage would exceed that for any other class of ships.

Suppose to all these considerations were added the net work of soliciting agencies and ticket offices of the Pennsylvania Railroad. Suppose that railroad should sail such vessels from Montauk Point, running boat trains from New York over its subsidiary the Long Island Railroad and in so doing reduce the time of transatlantic passage by 7 hours. The Canadian Pacific is making a success of its passenger steamship lines on both the Atlantic and Pacific. If they can do this in Canada, why not in the United States?

Motorship Makes Remarkable Record

ACCORDING to a letter sent to Admiral Benson from Captain R. H. Wright, master of the motorship *William Penn,* a carefully made record of all mileage covered, including sea voyages, rivers, canals and harbor movements, shows that this motorship traveled a total distance of 44,781 nautical miles in the year starting August 7, 1921, and ending August 7, 1922.

Captain Wright also stated that "during the whole of this period she has never made an involuntary stop, she has suffered no breakdown of any sort and her repair bill for actual repairs of all sorts is less than $100, United States currency.

"Her average speed for the period hereinbefore stated was 11.16 knots; her approximate fuel consumption has been 13 tons per diem, while her average consumption per diem in port has approximated 64 gallons."

The *William Penn* was originally designed for a steam installation but before completion it was decided to fit her with Burmeister and Wain type Diesel engines which was done at the yard of the William Cramp and Sons' Ship and Engine Building Company. She is a twin screw vessel of 17,000 tons displacement, having a deadweight carrying capacity of 12,375 tons and her engines are rated at 4,250 horsepower.

Her record for the year stated above is worthy of note for the number of nautical miles covered, the absence of a breakdown of any nature, the small cost of voyage repairs and the fuel consumption. Allowing due credit to her officers and particularly to Chief Engineer Olsen who showed the writer one of the cleanest and most shipshape looking engine rooms that he has ever seen when the *William Penn* was in New York harbor after her first voyage around the world, the performance of this vessel should have a decided influence on future machinery installations.

More than this, it should be a real inducement to shipowners to purchase a number of the tied-up Shipping Board vessels which can be obtained at very low figures and convert them to motorships. When a vessel's machinery runs a whole year without an involuntary stop, there can be no question of reliability; when the voyage repairs for that period are less than $100, the quality of the machinery cannot be excelled, but when you can operate a ship of that size on 13 tons of fuel per diem, when it would require at least 50 tons with a steam installation, then it is either time for shipowners to start acquiring motorships or for Diesel engine manufacturers to reduce the price of production to a point where the first cost figures do not require too long a time to make up the difference in cost of operation.

Ship Subsidy Is a Retaining Fee for National Defense

The "Merchant Marine Fund," Provided in the Shipping Bill, Should Be Called the "National Defense Retaining Fund"

By "Old Scotch"

IN the matter of national defense on the seas, many Americans, since the Washington Conference on Disarmament, have lulled themselves into a spirit of tranquility because by virtue of the 5-5-3 treaty with Great Britain and Japan we are on an equality with the world's greatest naval power. But is such the fact? Who among all of the people in the country fails to remember the terrific havoc wrought to the allied shipping by such raiders as the *Moewe* and *Eitel Frederick* and half a dozen more like them. Yet the German surface navy was supposed to be hermetically bottled up back of the guns of Heligoland and other impregnably fortified places. This little retrospection is simply to recall that merchant vessels are a very important means for sea strife, not to mention their value for carrying supplies, fuel and men to keep fighting vessels at sea, and to carry on military operations on foreign shores. Hence without a merchant marine, our 5-5-3 tranquility is somewhat of a myth.

Counting all merchant ships of 13 knots and upwards as available and necessary adjuncts to the regular fighting vessels we find the following comparisons between Great Britain and the United States:

Vessels Over 3,000 Tons	Great Britain	United States
13 to 18 knots speed..........	548	144
Over 18 knots speed..........	44	6

The above figures represent relative sizes of the two merchant marines for purposes of national defense as they were on January 1, 1922. If conditions continue as they are today, even our inferior proportion of the vessels quoted cannot be maintained, as many of our ships are idle and will rapidly depreciate in both physical and financial value. Suffice it to say that our tranquility regarding the 5-5 ratio is very evidently a myth, and that unless efforts are made by the Government to maintain the merchant fleet we now have, and to add a sufficient number of diversified types of craft to round out a sufficient and reliable supporting fleet of merchant vessels, our feeling of national security on the seas may at any time suffer a decided shock and rude awakening.

Enactment of Subsidy Bill Absolutely Necessary

The pending merchant marine bill, if enacted, is absolutely necessary to save us from such a shock, and attention is drawn to our palpable unpreparedness for national defense, so far as the necessary fleet of merchant ships is concerned, to emphasize the suggestion herein made, that this phase of the pending bill is of equal importance to the needs of maintaining a merchant fleet for our commercial interest.

The so-called "Subsidy Bill," has now been before the public for nearly a year, and such opposition as has been raised in the public press, has almost entirely been centered on the direct payment of money to shipowners, to enable them to overcome the handicap of higher initial costs and higher maintenance charges, when compared with similar merchant vessels operated by our foreign rivals.

People familiar with shipping, and with the terms of the pending bill, know that the object of this direct compensation is "To promote the growth of the foreign commerce of the United States," and "To contribute to the national defense," but to the average reader who gains his limited knowledge of maritime affairs from headlines in the daily press, the impression prevails that the entire object of the bill is to aid the owners of merchant ships to carry on their own business on the seas. The money to be raised for this purpose is called in the bill the "Merchant Marine Fund," which still further convinces the average citizen that his superficial estimate is correct.

Direct Subsidies Are for National Defense

As the maintenance of a merchant fleet in private hands is so distinctly a great national asset for purposes of the common defense on the seas, this direct payment to private shipowners should be made with the distinct understanding that it is a "Retaining Fee" from the Government to the private shipowner for having the first claim on his ships for purposes of national defense. The money with which it is paid should be taken from the "National Defense Retaining Fund," and it should be termed such in the pending bill. This should be stressed in all debates by the friends of the measure, and in all references in the public press, in order that the public may get away from the idea that shipowners are alone to benefit from the proposed legislation.

The idea of a "retaining fee" is now well established in our daily life, and it is not considered in the nature of a gift by any means. The first claim on services in emergencies which may arise is a "quid pro quo" generally recognized.

What the "National Defense Retaining Fund" Will Do

It is an indisputable fact that we must maintain a large merchant marine as a complement to naval preparedness in the defense of our country. With that as a basis, if we do not maintain such a fleet by means of the pending shipping bill, the only alternative is that the Government must build and maintain such a fleet of vessels as a part of its naval fleet. On the basis of the Retaining Fund idea, with ships in private ownership, this can be accomplished for \$30,000,000 per annum; in the event of the necessary merchant fleet being maintained under naval auspices and solely for defense purposes, the total expense would be enormous, and possibly would cost as much as the fighting ships of the regular navy as now maintained.

Without some such encouragement as now contemplated in the shipping bill, it needs no seer to predict that in a very short time our merchant marine would rapidly degenerate to its pre-war condition, where the number of efficient ships engaged in foreign trade could be counted on the fingers of both hands. Modern wars with our up-to-date systems of communication and transportation come very suddenly. No one expects or wants to see any more warfare in this generation, but the unexpected is what usually happens. A merchant fleet for use in the national defense cannot be improvised, built nor bought in an emergency. Our sins of omission in the matter of having merchant ships cost us more than three billions of dollars in the World War. In the light of so recent a catastrophe, are we again going to be caught in such a trap?

Of course there is bound to be captious criticism of the idea of paying retaining fees to shipowners for the first use

of ships in the time of national emergency. The arguments will be advanced that any one possessing equipment necessary or useful for war purposes should be the recipients of retaining fees for possible emergency use by the Government. The owners of large numbers of motor trucks, for example, might claim that as such vehicles are highly essential in the prosecution of a war, they should be recompensed for holding them in readiness and fit for use in times of strife. The answer to such claims is simple, as ships are in a class by themelves, in that they can be owned by American companies, and for purposes of economical operation may be sailed under alien flags.

It might be claimed that we can pass a law forbidding the transfer of flag on any ship now documented in this country. Very true, but how long would such procedure insure the operation of an efficient merchant fleet for naval purposes. All replacements of existing ships could be placed under foreign flags, and in a very brief time we would find American flag ships had disappeared from the seas; then where would we get the ships necessary for national defense?

The great fleet of merchant ships on the Lakes is not only unsuitable for ocean service, but unobtainable on account of canal restrictions. Our coastwise fleet is insufficient in number, type and size for the needs of the country in war times. It is a very recent date that a large exporting concern in this country found it cheaper to charter foreign vessels to transport its goods to Far Eastern ports than to use its own vessels under the American flag. Consequently they were tied up at the wharves. This would probably occur again, unless Congress provides some such relief as is contemplated by existing bills in Congress.

Prospects for Shipping Legislation Grow Brighter

Fortunately for everyone concerned the prospects for legislative relief are now more roseate than they were. President Harding and our Congressional leaders are determined to force action, even to the extent of calling on extra session shortly after the Fall elections. Rail and coal strikes have for a time taken the public attention away from what has been termed the most important question now before the American people.

The bonus for soldiers, and the tariff for protection of our industries, are very important for the time being, but they pale into insignificance when compared with the dire necessity for providing a lasting system for maintaining our merchant shipping, both for our commercial needs and for the defense of our country. The latter must not be subordinated in the popular mind, and it behooves Congress and the public as well to consider the expenditures proposed of equal importance for both of the benefits to be derived—commercial independence on the seas and adequate national protection.

American Marine Week Comes at Psychological Time

Cooperative Efforts of Eighteen Maritime Associations Will Exert Powerful Influence on Pending Shipping Legislation

Naval Architects to Hold Convention in Auditorium of Grand Central Palace Reduced Rail Fares for Exposition Delegates Secured

The Marine Exposition and the conventions and meetings of the maritime associations which will be held at the Grand Central Palace, New York City, November 4-11, coming as they do just before the shipping bill is taken up in Congress, are bound to have a very favorable effect on securing reasonable National protection for our shipping.

Whether taking it from the standpoint of designing, building or operating, the American maritime industry is now fighting with its back against the wall. But even as we were not too late in entering the World War so it is now not too late for Congress to grant protection to an industry that is becoming more and more of vital importance to the prosperity and safety of the country.

Therefore, no one who can possibly get away from his work should fail to attend and support this united endeavor of the marine industry. The personal benefit of inspecting the latest marine equipment and renewing and making new acquaintances will be great but the value of a record breaking attendance at this big gathering will, to the industry as a whole, be of greater value.

Naval Architects' Meeting

The Thirtieth Annual Convention of the Society of Naval Architects and Marine Engineers will be held in the Auditorium of the Grand Central Palace, Lexington Avenue and 46th Street, Wednesday and Thursday, November 8 and 9, 1922. Professional sessions will begin at 10 A. M. each day.

In order to extend acquaintanceships, a reception committee will be appointed. New members or members who have not attended previous meetings should get in touch with the reception committee on arrival at the meeting.

Arrangements have been made to register all members upon entrance at the Grand Central Palace. The data will be on hand at all times at the announcement desk and will be of great service to any of the members who desire to keep in touch with each other during the convention period.

Prior to the general meeting, the Council of the Society will meet at 3 P. M. Tuesday, November 7, in room 1101 of the Engineering Societies Building, 29 West 39th Street, New York, N. Y.

Program of Professional Sessions

Below is given a list of papers to be read. Members may obtain advance copies of the papers by applying to the Society headquarters, 29 West 39th St., New York, N. Y. In presenting papers, each author will be limited to twenty minutes for the reading of an abstract of the paper; this time to include the showing of lantern slides, if any are to be used. Remarks in discussion of papers will be limited to ten minutes for delivery, including the showing of lantern slides.

Wednesday, November 8

"Automatic Steering." By Elmer A. Sperry.

"Details of Naval Design from Jutland." By Commander Herbert S. Howard, C.C., U.S.N.

"The Application of Dyson's Method to Propellers of Ocean-Going Merchant Vessels." By Edwin A. Stevens, Jr.

"Stresses on Vessels of The Great Lakes Due to Waves of Varying Lengths and Heights." By Professor H. C. Sadler and Professor Anders Lindblad.

"A Study of the Wake of Certain Models by Means of a Current Meter." By Professor Edward M. Bragg.

"Some Experiments on Propeller Position and Propulsive Efficiency." By Rear Admiral D. W. Taylor, CC., U.S.N.

Thursday, November 9

"Efficiency in the Operation of Steamships." By Captain Daniel A. J. Sullivan.

"A Sixteen Hundred and Fifty Horsepower Gasoline Fire Boat." By Arthur D. Stevens.

"The Longitudinal Strength of Rigid Airships." By Professor William Hovgaard.

"Machinery and Trials of the Passenger Ships—American Legion Class." By Robert Warriner.

"Standardization as Affecting the Shipbuilding Industry in the United States." By Ernest H. Rigg.

"The Selection of the Best Kind of Propelling Machinery." By James L. Ackerson.

Naval Architects and Marine Engineers' Banquet

The annual banquet will be held in the Grand Ball Room of the Waldorf-Astoria, 34th Street and Fifth Avenue, New York, on Thursday evening, November 9, at 7.30 P. M. Immediately preceding the banquet there will be a reception beginning at 7.00 P. M. All members and their guests are cordially invited.

Seats for the banquet will be $6.00 each. Each application for tables or seats should be accompanied by remittance and made by letter so as to reach the secretary on or before November 2. Telephone requests must be confirmed by letter.

Members submitting applications for reserved tables should state the number in their party who are not members of the Society. Applications for reservations for more than three tables (30 seats) will, by direction of the executive committee, require special approval, which approval can only be given in the discretion of the committee, after the reasonable requirements of other members of the Society have been met.

Reduced Rail Fares

Another announcement of interest and importance is the statement that the Trunk Lines Association has granted a reduced fare rate for all delegates attending any of the meetings in conjunction with the American Marine Association and Marine Week. Persons coming to New York will purchase full priced tickets at their point of departure and will request an identification convention certificate. Upon arrival at the Exposition, the certificates will be validated by the chairman of the Transportation Committee, John A. Hense. Upon returning, holders of the certificates may present them at any ticket window and receive a ticket at half fare, or a saving of 25 percent.

The transportation committee has also arranged adequate facilities in the way of a ticket office, reservation bureau, etc., at the show, and will also maintain a New York City sightseeing bureau where visiting delegates and strangers in the city may arrange for tours.

List of Other Attractions

A partial list of other attractions, maritime organizations that have so far signified their intention of taking part in the Exposition, and the manner in which they will participate, is given in a report of the Liaison Committee of the American Marine Association, as follows:

1. The Shipping Board—by an exhibit. Plans are under way to secure addresses from Chairman Lasker and other commissioners on the shipping bill or other projects on which the board is working.

2. The Navy Department—by an exhibit and also by addresses of leading naval officials.

3. The Department of Commerce—will stage a combined exhibit of their various marine bureaus which will occupy about 2,000 square feet of floor space. The heads of several bureaus of the Department of Commerce have promised to deliver addresses during the week.

4. The Society of Naval Architects and Marine Engineers—will hold its annual convention *November* 8 *and* 9 in the auditorium of the Grand Central Palace, and its annual banquet on the evening of *November* 9 at the Waldorf Astoria.

5. The Maritime Association of the Port of New York—by an exhibit. They have also appointed Fred B. Dalzell, Jr., chairman of a committee to co-operate in every possible way with the maritime organizations taking part in American Marine Week. Mr. Dalzell has guaranteed that speakers from this organization will be available.

6. The American Steamship Owners' Association—will hold its quarterly meeting on Monday, November 6. Mr. Marvin, vice-president of the organization, assures us that speakers will be available and he is endeavoring to secure attendance at the Exposition of their official technical committee and the members of their organization.

7. New York Tow Boat Exchange—This organization will take part through an official committee and will also furnish a moving picture film of tow boating in New York Harbor.

8. Ocean Officers' Conference (composed of captains, mates, engineers and radio telegraphers)—This organization has agreed to hold a smoker in the auditorium of the Grand Central Palace.

9. Atlantic Coast Shipbuilders' Association—J. L. Ackerson, president, states that the organization will be represented at least by an official committee and that he will try to give us still greater co-operation. Plans are under way to secure speakers from this organization during the week.

10. American Bureau of Shipping—will hold meetings of the board of managers and will hold meetings of their technical committees on both naval architecture and marine engineering.

11. National Merchant Marine Association—We have received letters from this organization stating that they would be glad to co-operate with us and have asked for suggestions as to the best way to do this.

12. American Society of Marine Designers—will be represented by a booth at the exposition and will also be represented by the executive committee of the national organization. This society will not hold a convention this year.

13. The Neptune Association—Captain Milliken, secretary-treasurer, has promised us that he will support American Marine week in any way he can.

14. The Port of New York Authority—will exhibit at the Exposition and co-operate in American Marine Week.

15. Mississippi Valley Association—Plans for this association are under way.

16. Los Angeles Chamber of Commerce—has the matter of exhibiting under consideration.

17. San Francisco Chamber of Commerce—D. K. Grady, Director of Foreign and Domestic Trade Department, is now working on the best way for the San Francisco Chamber of Commerce to cooperate.

18. The American Society of Naval Engineers will have a booth at the Marine Exposition. They will have at their booth bound volumes of their transactions and other interesting material.

The interest in American Marine Week that has been shown by the above organizations proves that the idea of one annual get-together week at the same time and in conjunction with the Marine Exposition has taken firm root. It is particularly fortunate that such extensive cooperation has been extended this year because it will not only assure a splendid and profitable time to all who attend but it will also exert a great influence upon the future of our merchant marine.

What the Shipping Bill Is and Does

By Winthrop L. Marvin*

It should be emphasized that it is now costing about $50,000,000 *a year to maintain* 450 *steamers of the Shipping Board. The new shipping bill will aid and encourage, not only these government-owned steamers when they have passed into private hands, but also American private shipping in the foreign trade, now without any assistance whatsoever from the United States. In other words, an expenditure of an amount less than that which the Shipping Board is now paying for the maintenance of its own fleet will, in this bill, cover the entire American merchant marine in overseas commerce.*

JUST what the new shipping bill is and does—just how far it goes in bestowing National aid on the merchant marine—what its cost is and what its duration—all this is well worth pointing out from amongst the more than half a hundred legal pages in which its various terms are meticulously expressed.

In the first place, in its very first paragraph, the new bill broadens the first Jones law, the Merchant Marine Act of 1920, to facilitate the quick sale of the government-owned ships to private capital and enterprise. There can be no shadow of a doubt that all but a few scattering members of both political parties in this country very strongly desire a privately-owned and controlled merchant marine. Advocates of a permanent government-owned shipping are about as scarce in the United States as genuine specimens of the Russian Bolsheviki.

Public opinion emphatically approves the initial provision of the new bill directing the Shipping Board to sell all the government tonnage to "citizens of the United States, except as provided in section 6" of the Act of 1920. This exception permits the sale to foreigners of vessels that are not sought by American purchasers. Under this provision there are now occasional sales to aliens, by authority of the Shipping Board.

In the Merchant Marine Act of 1920, the Board in disposing of its tonnage, is constrained to give heed to the previous prices and replacement costs of ships. Strictly interpreted, that might prove a veto on the disposal for $30 a deadweight ton of cargo craft that in the war emergency had cost $200 or more a ton. Such impossible restrictions are swept away in the present bill, with general approval—for few men would wish to retain an unworkable plan, which would block every effort of the Government to extricate itself from the shipping business. Even those Democrats of the House Committee on Merchant Marine and Fisheries who signed the minority report against the Shipping bill as a whole are careful to protest that "we are opposed to permanent government ownership or operation of merchant ships."

Sale of Ships

Sales of ships, under the proposed bill, must be by "public or private competitive sale after appraisal and due advertisement"—but the Board is empowered to waive advertisement and competitive sale by affirmative vote of at least five of its seven members, making a public record of the reasons for their action. Complete payment of purchase price and interest must be made within 15 years. Interest, payable at least annually, shall be at a rate of not less than 4 percent, and payments of the principal shall be so arranged as to cover at any time depreciation of a vessel—unless the Board waives this requirement on the giving of adequate security by the purchasers. Thus, with the added restrictions and limitations of the law of 1920, there are abundant safeguards of the Government as a seller.

Another new clause amendatory of the Merchant Marine Act of 1920 is a provision in section 2 of the new bill reserving for at least two years the purchase of lines now locally controlled to the local companies now operating these services, with a view to "discouraging monopoly in the American merchant marine." This makes it probable that the new companies organized at South Atlantic and Gulf ports to operate Shipping Board routes will remain in control of those routes under the new policy of cessation of allocation, with National aid to private ownership and enterprise. This is a provision that strongly commends the bill to the favor of the South and Southwest.

In the Merchant Marine Act of 1920, there was authority for the expenditure of $25,000,000 a year for 5 years as a revolving loan fund, at an interest rate of not less than 2 percent, for the encouragement of construction in American yards of particularly necessary types of ships—fast mail steamers of the naval reserve, Diesel-engined cargo craft, etc. This is an expedient that many foreign governments have successfully employed—a notable case was the British government loan for the building of the *Mauretania* and *Lusitania.* In the Shipping bill the authority covers the construction and equipment of special ships, the Government to be protected by a first lien on the vessel. All loans must be repaid within 15 years.

It is to be borne in mind that this is not a gift fund but a revolving loan fund to come back into the Treasury.

Income Tax Deductions

These are the amendments to the Merchant Marine Act of 1920. In section 201 of the new Shipping bill is a very important plan of indirect aid to the merchant marine, amending the Revenue Act of 1921, so that for 8 years from 1921, a shipowner shall be allowed, as a deduction in computing net income, "an amount which bears the same ratio to his net income during the taxable year attributable to the operations of such vessel as his gross income attributable to the foreign operations of such vessel bears to his entire gross income attributable to the operations of such vessel." But this deduction is conditional upon the amount of the deduction being set aside for the building of new ships in private American shipyards. So also any taxable gain on the sale of any ship launched prior to January 1, 1914, may be counted as a deduction if the entire proceeds of the sale are devoted to new construction, or if less than this amount the deduction shall be proportionately reduced. Section 203 of the new Shipping bill amends the Revenue Act of 1921 to make more liberal allowance for actual depreciation of vessel property of all kinds.

Section 204 creates a new and ingenious method of indirect encouragement to the merchant marine by crediting shippers of exports and imports with 5 percent of the amount of freight money paid to American ships, as a deduction in computing Federal income taxes—but it is stipulated that this deduction "shall not be allowed with reference to transactions between persons who are affiliated"—that is to say,

* Vice-president and general manager, American Steamship Owners' Association, New York.

between corporations one of which owns more than 50 percent of the stock of the other.

Next comes, in section 206 of the new bill, the first provision for the raising of revenue to meet the expenditures. This is in the form of a doubling of the tonnage taxes and light money payable in our ports by all vessels, American and foreign, arriving in the foreign trade. Such an increase will produce a total revenue of about $4,000,000 a year, or double the present amount.

Transportation of Immigrants

A tremendously powerful new agency for the creation and maintenance of a first class naval reserve is embodied in section 301 of the Shipping bill, with its declaration that "as nearly as practicable one-half of the total number of immigrants admitted to the United States in any fiscal year shall be transported in vessels registered or enrolled and licensed under the laws of the United States."

In practical effect this would mean that one-half of the immigrants from the United Kingdom would come in American and one-half in British ships; of the immigrants from Germany one-half in American and one-half in German ships; of the immigrants from Italy one-half in American and one-half in Italian ships, and so on. This plan is so manifestly just and equitable that European shipping interests, which have a mortal fear and hate of the American bill, despair of finding any plausible pretext to defeat it. Their suggestion that commercial treaties forbid such a policy is upset by the well-known fact that before the world war those Europeans themselves had a working agreement by which the carrying of virtually all of our immigrants was regularly monopolized by foreign companies, a certain proportion to each company. Treaty prohibition was then undreamed of, but the bill arms the President with authority to "denounce" any section of any treaty as to which this point may now belatedly be raised.

Naval Reserve Fleet

Most valuable of all ships for National defence are the great, swift passenger carriers of the North Atlantic. Under this immigration section America is assured of as strong a naval reserve fleet as the United Kingdom, thus guaranteeing in logical effect the principle of the Washington 5-5-3 agreement of 1920, under which our naval power was to be equal to Great Britain's and about twice Japan's.

Subvention, subsidy, "compensation," as President Harding justly calls it, first appears in the Shipping bill in section 401 by which the merchant marine fund is established in the Treasury department. This fund is to be made up of the increased tonnage taxes, already alluded to, ($4,000,000 a year); 10 percent of the customs revenue (or about $30,000,000 a year); amounts that but for the general compensation would have to be paid under contract for carrying the ocean mails (except parcel post) (or about $4,000,000 a year), and in addition certain repayments to shipowners. From this fund amounting to from $36,000,000 to $40,000,000 a year, certain specific rates of compensation are to be paid under contract for 10 years to all American vessels engaged in overseas trade, calculated as to cargo vessels to meet the difference between American shipboard wages and subsistence and the wages and subsistence of their chief foreign competitors, and as to the swift mail, passenger and cargo vessels, to cover the difference in wages and subsistence, and also the subventions or subsidies of foreign governments.

Direct Compensation

The Shipping Board is charged with making these contracts only with capable and responsible persons or corporations. In amount this compensation begins with a rate of one-half of one cent per gross ton of a sailing vessel of at least 1,000 gross tons or of a steamer of at least 1,500 gross tons, for each 100 miles sailed in foreign commerce—steamers of from 1,500 to 5,000 gross tons are compensated as of 5,000 tons gross register. Power-driven vessels of a speed of 12 knots or over and less than 13 knots are to have an added compensation of one-tenth of one cent per gross ton for each 100 nautical miles sailed in foreign commerce—and so on by a carefully proportioned scale up to an additional two and one-tenth cents per gross ton for 100 nautical miles sailed by steamers of 23 knots and over. Mileage is to be measured by direct customary routes. On this basis, a 5,000-ton cargo steamer of 10 knots speed might receive a compensation of about $7,500 a year, while the 24-knot *Leviathan* of 54,000 tons might receive $900,000—a sum not out of proportion to what the British Government has long been paying the Cunard Company for similar service.

To emphasize the fact that all this compensation for either cargo craft or giant liners is for actual service rendered, certain conditions of National importance are established. In order to receive this compensation, ships must be already registered or hereafter built in the United States—with certain special exceptions. They must hold the highest classification of the American Bureau of Shipping—the "American Lloyds"; they must be self-propelled by sails or machinery, and must carry officers who are duly certificated American citizens, and crews exclusive of officers at least two-thirds of whom after two years are American citizens, the remainder to be persons eligible to citizenship. It is emphasized again that this compensation is given only to ships engaged in foreign commerce, and voyages in such commerce are strictly defined.

No compensation under the Act is to be paid to ships not of private ownership or not owned by citizens of the United States. After three years no company whose own or chartered tonnage, or the tonnage of whose affiliated companies, is not at least 75 percent of American register shall be eligible for compensation.

Wisely, some discretion is given to the Shipping Board to increase the rate of compensation by a record vote of five out of seven members, on routes where especially intense foreign competition makes this necessary—but the increase shall not be more than double. The Board is also authorized to reduce the rate of compensation where the rate seems excessive, with the consent of the other party to the contract.

Vessels receiving compensation may be requisitioned by the Government at any time for National defence or in a National emergency, on a basis of fair actual value, but in no case "shall such fair actual value be enhanced by the causes necessitating the taking." All repairs or reconditioning of compensated vessels must be made in the United States or its possessions (except such repairs as are necessary to the safety of the vessel) on penalty of withdrawn compensation.

Ocean Mail Service

Steamers receiving compensation must carry free of charge all ocean mails except parcel post. Owners whose vessels earn a net income of more than 10 percent must pay 50 percent of the excess to the United States, "but in no case shall the amount so to be paid exceed the amount of compensation earned in respect to such vessel." This requirement, of course, is intended as a vigorous check on profiteering.

All army or navy transport services are to be discontinued wherever the President finds that adequate facilities exist in private hands, and the government-owned transports are to be turned over to the Shipping Board or laid up, while the requisite services are to be performed by privately-owned American vessels under contract. All government officers must travel on American steamers whenever available, if

(*Continued on page* 642)

Standardizing Ocean Bills of Lading

By Robert E. Annin

It is safe to assert that a very large proportion of ocean shippers today have little realization of the conditions to which the acceptance of the ordinary form of bill of lading may bind them; and the substitution of one well-digested and carefully framed code for a mass of unknown verbiage of uncertain effect would in itself be a great protection to all shippers, even to those who did not know the provisions of the code itself. At least they would be guaranteed against certain lopsided absurdities which might practically deprive them of vital rights.

IN view of the vital character of the bill of lading as a receipt, an evidence of contract and a collateral document, it would, at first glance, seem surprising that there is not yet in general use a form so definite in its statement of ordinary responsibilities and exemptions, as to be satisfactory to the interests necessarily involved—that is to say the carrier, the underwriter and the holder for value (which includes the shipper or his assignees). For with the rapid growth of international trade, for over a century, there has been devoted to the problem a wealth of ability—commercial, financial, legal and judicial—which, it would seem, should have been sufficient to reach a result reasonably satisfactory to all parties concerned.

It is only when one considers the possible complications arising from sea-perils, the infinite variety of goods transported, diversity of voyages and the differences in jurisdictions which enter into international trade, that the obstacles to a just and comprehensive form of bill of lading can be appreciated.

In view of these factors, the best conceivable form could do no more than reduce the inherent risks of dispute and litigation, even if special forms could be devised, covering every kind of merchandise, on any possible voyage, under every possible combination of conditions, which is obviously impossible.

Since the bill of lading form usually originates with the carrier (who naturally protects himself to the utmost), the demand for reform has come either from the cargo owner (or his assignee) or from the underwriter, who assumes most of the liabilities for loss or damage which cannot be collected from the carrier.

And as a negotiable bill of lading is not only an evidence of contract for carriage, but the vital document in the set of commercial collateral, all provisions which leave in doubt the relative risks and liabilities of the parties in interest, must tend to impair its value and act as a potential cause of injustice to any holder.

Clear Definitions Important

Hence the interest of the underwriter in a clear definition of the carrier's responsibilities is obvious; for only so may he intelligently estimate his own risk.

To the banker it is essential that, if his security be impaired by loss or damage, he shall have well-defined recourse against either the ship or the insurance. Otherwise he may risk falling between two stools, with no remedy, save in a dilatory and expensive litigation.

A curious case which occurred some years ago will illustrate this point. A shipment of cotton sheetings, in transit by a passenger and freight liner, was seriously damaged by the leakage of a bathroom pipe. The underwriters referred claimants to the carrier, holding that "sea peril" did not cover the kind of damage sustained. On the other hand the carrier rejected the claim, on the ground that the leakage was caused by straining of the ship, and consequently the damage was due to "sea peril." Whether the plumbing was originally defective, or the break caused by stress of weather on the voyage, seemed impossible of proof. The dispute dragged along for some months, when the underwriters, under pressure, accepted the liability and paid the claim in consideration of cargo owner's assignment of their claim against the carrier. Eventually, an amicable settlement was made by which carrier and underwriters each bore one half of the total loss.

In this particular case the shipper was a large insurer, with an enviable record as to claims, while the claim was not large. Furthermore, the essence of the matter lay in a question of fact, rather than of interpretation. But it is a clear example of the possible loss involved to an innocent holder of the bill of lading, whenever the line is not clearly drawn between the liability of the carrier and that of the insurer.

Unjust Exemption Clauses

Hence the demand for legislation which shall restrain carriers from inserting in their forms, unjust, obscure or tricky clauses, exempting them from their just responsibilities and transferring to other parties in interest the risks for which the ship is properly liable.

The conditions of international trade during the years just passed have brought this matter to an acute stage. For the collapse of markets, credits and exchanges has loaded bankers with "frozen credits." Drawees have failed to meet their drafts; drawers have been unable to take them up and the holder's sole tangible security has been the value of goods. When to this is added the fall in price and the anxiety of both owners and underwriters to plead any technicality to escape payment of claims the urgent demand for bill of lading reform is easily understood.

The trouble, at this juncture, has been further intensified by unusual and unjust exemption clauses inserted in their form by some carriers, under the plea of "war conditions"; and which in many cases have survived the emergencies which served as their excuse.

While the war lasted, and for a year thereafter, the insufficiency of tonnage was so great that shippers were willing to accept almost any bill of lading so long as their goods were moved.

A glaring instance of this kind is the following clause inserted in a "war" bill of lading and accepted without demur by many shippers:

"For the purpose of ascertaining the amount of freight to be charged, the shippers shall make a written declaration, before shipment, of the true contents and value of each package; and any failure to make such declaration, *or the making of any incorrect or insufficient declaration, shall release the carriers from all responsibility and shall entitle them to charge double freight,* calculated according to the true contents and/or value of the goods."

The effect of such a clause upon the value of the bill of lading as collateral needs no comment. That it would receive judicial sanction is doubtful, but that it would cause litigation is very certain; a fact which of itself greatly impairs the value of any collateral document.

Stipulations Not Necessarily Final

While a bill of lading as a contract is not assailable by parole evidence and while the courts are disinclined, for obvious reasons, to nullify its express stipulations, it cannot be assumed that its provisions are necessarily final in all cases. A long standing decision on this point holds the following language:

"A bill of lading is not the contract, but only evidence of the contract; and it does not follow that a person who accepts the bill of lading which the shipowner hands him is necessarily and without regard to circumstances bound to abide by all its stipulations."

The same decision held that in case of novel or unusual clauses, vitally affecting the ship's liability, the shipowner is obligated not only to make it plain in words, but conspicuous in type and position.

Further, courts have long shown an increasing tendency to interpret the bill of lading along lines which reasonably recognize its vital importance in international commerce, and the special risks to which bankers and underwriters may be subjected without a fair chance to protect their interests. A clear division of liabilities and risks incident to ocean transportation is one of the roots of a safe international commerce.

For such reasons the call for standardization has become increasingly clamorous and has taken form in two directions:

(a) By a movement acting through the British Board of Trade for legislation on the subject to cover all British territory.

(b) By the formulation of a code of international regulation which has become widely known as the "Hague Rules."

The former may be framed either on identical lines with the Hague Rules, or (as has been proposed) upon the model of the existing Canadian Act; in which case its effect would be restricted to the British Empire itself. The latter would require the assent of the interested Governments to become generally effective. There is a strong movement to accomplish the adoption of the Hague Rules through action of our own Congress. It is true that much of the ground which it is sought to cover has been already covered in the Act of Congress of 1893, known as the Harter Act. But the latter is 30 years old, has shown some hazy spots and could undoubtedly be improved in the light of so many years of experience and judicial review.

No Code Can Completely Cover Every Trade

As before stated, no code could be attempted which should provide a complete form for every trade, every jurisdiction and every class of cargo. The aim is rather to frame a set of rules which shall be clearly expressed, easily grasped and which being briefly made a part of all bills of lading (by the same method now used to give effect to the Harter Act and the York-Antwerp Rules) would not only accomplish the purpose desired, but by such method would automatically shorten and simplify the bill of lading form. This is in itself an end worth achieving, for the interminable length of many forms now in use is an injustice to shipper, banker and underwriter, only less than that caused by unconscionable provisions.

The Hague Rules were originally drafted by the Maritime Law Committee of the International Law Association, in the endeavor to lessen and, if possible, remove the universal friction between carriers and holders of bills of lading which has been growing for years; but which became particularly acute about the end of the war period. Previous to this, the Prime Ministers of Great Britain and her Dominions had moved in the same direction and British legislation was already in prospect which should cover all that Empire, but would of course be ineffective beyond its boundaries. The purpose of the International Law Association has been to broaden the movement, so that, by the formulation of a code acceptable to all the martime nations, the reform might be made of world scope.

International Code Framed at The Hague

At a general conference of the International Law Association, which met at The Hague in August last, the rules drafted by their Maritime Law Committee were submitted, exhaustively discussed and (after certain amendments) this code, known from the town of its adoption as the Hague Rules, was adopted unanimously.

The ability and time given to the framing of these regulations have given them such prestige, and wide discussion of their provisions has so justified their wisdom and fairness, that there is good hope that many of the maritime nations, headed by Great Britain, may adopt the essence of the Hague Rules as a part of their maritime law. The International Chamber of Commerce is taking an active interest in promoting the movement and a majority of those interested in this country are in hearty accord with their purposes.

It will not be practicable in the space available to quote the rules in full and comment thereon; but a brief summary of the provisions of the various sections with some comments on the more vital should be of interest.

Articles I and II

In the Hague Rules as written Articles I and II are formal, the first defining the essential terms "Carrier," "Contract of Carriage," "Goods," "Ship" and "Carriage of Goods." The second makes the rules binding upon the carrier.

Article III

Article III is devoted to the carrier's responsibilities and liabilities. Section one of this article states the ends toward the accomplishment of which the carrier is obligated to exercise due diligence "before and at the beginning of the voyage."

Section two provides for loading and discharging and care of cargo while in carrier's custody.

Section three treats of the issuance of bill of lading, on demand of shipper as soon as goods are in carrier's custody; and of the descriptive details which such document shall show.

Section four provides that (with the exception of bulk goods) the bill of lading shall be prima facie evidence as to marks, quantity, description and condition, at time of shipment.

Section five is, on its face, for the special protection of the carrier, but in effect it is for protection of the shipper against just such clauses as the one quoted some time back. It provides that the shipper shall indemnify the carrier for any loss, damage or expense resulting from inaccurate descriptions.

Section six treats of claim for loss or damage; of the giving of notice by claimant, and discharges the carrier in respect of loss or damage, unless suit is brought within twelve months after delivery of goods.

Section seven provides that shipper shall be entitled, when goods have been loaded, to demand a bill of lading stating that goods have been "shipped" instead of "received for shipment"—a point upon which later comment is to be made.

Article IV

Article IV treats of the rights and immunities of ship or carrier.

Section one has broadly the effect of the Jason Decision under the Harter Act in exempting the owner for unseaworthiness not caused by lack of due diligence on the part of the carrier.

Section two is in effect the provision setting forth the exemptions to which the carrier and/or the ship are justly entitled. It is notable for its relative brevity and clarity, being content with the more general descriptions of causes of loss for which the carrier shall not be responsible, instead of attempting an impossible completeness of detail. For such detail is substituted one last paragraph (q) which specifies among the exemptions

"Any other cause arising without the actual fault or privity of the carrier; or without the fault or neglect of the agents, servants or employees of the carrier."

Section three contains the deviation clause.

Section four limits carrier's liability to £100 per package, unless a higher value be declared by the shipper, before shipment, and inserted in the bill of lading. Herein is covered one of the points which have caused complaint, friction and conflict.

Section five exempts carrier or ship from responsibility for all loss or damage in connection with goods the nature or value of which has been *wilfully* misstated by the shipper.

Section six grants to the carrier full freedom of protective action in regard to dangerous cargo, the nature of which has been concealed by the shipper; deprives shipper of any claim for compensation and makes him liable for all loss or damage due to his failure to declare the true nature of the cargo.

Article V

Article V provides for goods carried under special agreements not in accord with the preceding rules. Such contracts are to be legal but no negotiable bill of lading is to be issued under them. In lieu thereof, the agreed terms are to be embodied in a receipt, marked *"not negotiable."* The effect of this rule, in preventing the misleading of holders for value through special agreements between shipper and carrier, as well as placing the sole onus of such agreements upon the parties directly assenting to them, is very clear.

The code as proposed is mainly drawn along the lines of the Harter Act, and like that law, it is primarily intended for the protection of other interested parties against arbitrary and unjust provisions dictated by the carrier or ship.

In the provisions for due diligence it is plainly implied that the burden of proof that such due diligence has been exercised shall rest upon the carrier. The cargo owner does not have to prove negligence. This might be made clearer by direct expression, but the intent appears unmistakable. In brief the Hague Rules aim (as does the Harter Act)

(1) To prohibit the evasion of certain vital obligations by the carrier.

(2) To clearly and tersely define the just exemptions of the carrier.

The ultimate purpose is to make the application of such prohibitions and definitions general, instead of (in the international sense) local.

But this code also covers certain matters long in controversy upon which the Harter Act does not touch.

Specifically in Article III, Section 6, it is stipulated that in the absence of written notice of claim served upon the carrier at port of discharge before removal of the goods, such removal shall be prima-facie evidence of delivery. Further that failure to bring suit within 12 months of delivery shall discharge the carrier from all liability in respect of loss or damage. This is in sharp contrast with clauses commonly in use which, in some cases, have exempted the carrier absolutely unless written notice of claim be served within ten days of removal; and limiting to three months the period within which suit may be brought. Clearly, in view of the possibilities of delay in the detection of damage (arising from transshipment, warehousing, and other causes), the period for the absolute exemption of carrier has often been too short. The acceptance of the goods being made *prima facie* evidence of delivery places the burden of proof of damage upon the cargo, but does not absolutely release carrier.

In view of the time and labor required in seeking and formulating evidence, the difficulty of locating witnesses, etc., the period of one year allowed for the beginning of litigation appears reasonable.

Much trouble and confusion has resulted from the issuance by carrier of bills of lading which failed to name definitely the vessel upon which cargo had been shipped. Presumably this practice arose with the use of "Through Bills of Lading" where (owing to uncertainties of transport to seaboard) it was impossible to guarantee that a given consignment would arrive in time for shipment by a given ship. Carriers were quick to perceive the advantage to themselves of a form which, instead of binding them to the statement that the goods were *"Shipped per"* a given vessel, merely stated that goods had been *"Received for shipment per———"* or succeeding vessel of the same line. Under the latter form the privilege to the carrier of selecting the most profitable cargo for immediate shipment, and of shutting out less desirable consignments led to infinite confusion, trouble and loss. Not only were split shipments common, but shipper, consignee, banker and underwriter were often uncertain regarding the identity of the vessel to which their risks attached. This form was therefore a convenience to the ship but an injustice to all other interests.

Hence in Article III, Section 7, it is provided that when goods are actually aboard, the shipper shall be entitled to demand, and the carrier must issue, a *"Shipped"* bill of lading, provided no *"Received for shipment"* bill of lading has previously been issued.

But, if the latter has been already issued, it shall (on goods being laden and on demand of shipper) be exchangeable for a "Shipped" bill of lading; or a "Received for Shipment" form may acquire the standing of a "Shipped" form, by proper notation of name of ship and date of lading, by the carrier, master or agent.

This does not altogether avoid the complications of a "Received for Shipment" form, but certainly greatly modifies them.

Cargo of Unusual Value

The reform of another abuse is covered in Article IV, Section 4. That the carrier may have some knowledge of the risks which he undertakes it is essential that he be informed concerning cargo of unusual value. In regard to precious stones or metals, securities, laces, furs, and certain other valuable commodities, which are subject to special perils of theft or damage, the ordinary bill of lading requires a special declaration of the shipper at the time the engagement is made. This is clearly just, since the carrier's risk as to loss and damage is in proportion to the value of the goods carried and he is entitled to be warned in advance regarding any items which are subject to peculiar risks, in order that proper protection may surround them.

But also to cover this matter in a more general way there has been a customary clause placing a maximum risk *per package* on all goods the value of which has not been declared in advance by the shipper.

As it is to the interest of the carrier that this maximum should be as low as possible the tendency has been to reduce it below a reasonable figure to the great disadvantage of the shipper in case of loss. Article IV, Section 4, places this general maximum at £100 per package also providing that, by special agreement any other maximum, *not less than* £100-0-0, may be substituted.

This section also very properly stipulates that shipper's declaration shall only be *prima facie* evidence as to value, etc., but shall not be binding upon the carrier. Otherwise it might be claimed that acceptance of declaration of value would estop the carrier from later disputing its accuracy, thus opening the door to a very obvious kind of fraud.

These are the main features of the so-called Hague Rules which, to be made fully effective must be made part of the statute law of the great maritime nations.

As this is written the subject is under active discussion in the United Kingdom and many suggestions of amendment and alteration have been made. The tendency of most of these, however, seems to be toward greater simplicity and definiteness and indicates that the British interests involved are in dead earnest in their endeavor to better present conditions. Presumably this process will have to be gone through with each national parliament and the consequent delay is quite likely to endanger the general success of the Hague Code. In the interest of international trade it is to be hoped that this movement will succeed. The unification of law and practice in respect of these matters would simplify and therefore facilitiate international commerce. Whatever does this is in the long run beneficial to both owner and operator; while the interests of bankers and underwriters are too obvious to need comment.

Hence the speedy success of these rules is greatly to be desired in the interest of ocean trade.

Recent Developments in Marine Insurance

Deviations for Fuel—Pilferage Liability—War Clause Altered—Proposed State Law—Shipping Destroyed in 1921

By "Bordereaux"

COAL shortage continues to be the cause of considerable anxiety to marine underwriters, for more reasons than one. They are checking up on voyages with the greatest care, watching particularly for deviations for fuel. Recently several English vessels that loaded at New York for the River Plate proceeded to Sydney, Cape Breton Island, for coal, not having been able to fill their bunkers here. They found at Sydney that they could not secure a sufficient supply and were obliged to go to Norfolk to get it. All this involved extensive and perilous deviations and the underwriters, very properly, charged an additional premium of from one-eighth to twenty cents. Many serious hazards are caused by these entries into other ports than those contemplated in the prescribed voyage. Collisions are always possible and the peril of fire damage is never absent when hatches are opened for the reception of coal.

Would Sue the Government

PERMISSION to bring suit against the Federal Government is something the marine underwriters are very desirous of securing. Behind it lies the important question of the liability of the Government for war damage. The insurance men want to see the Husted bill, now pending before the Congress, reported out of committee; if this measure can not be passed, they want a new bill introduced. The Husted bill seeks to secure permission to bring suit against the Government. A few days ago a special meeting of marine insurers was held at New York for the purpose of inaugurating an inquiry of nation-wide scope into the liability of the United States Government for war damages. It is desired to have this action taken up all over the country, as in such an event it would present vastly more strength than if pushed by any local interests. William H. McGee presided, and the meeting authorized him to appoint a committee that should study the situation and devise ways and means for meeting it. After mature consideration Mr. McGee made the following appointments to the committee, of which he himself will act as chairman: Curtis L. Clay, Philadelphia, representing the Insurance Company of North America; W. H. Jones, of S. D. McComb & Company; H. E. Reed, of the Fireman's Fund; H. A. Warden, of the Automobile; and G. B. Ogden, of Chubb & Son.

Havana Trouble Feared

THERE appears to be good reason for fearing the development of another period of congestion at Havana approximating in extent the chaotic conditions that prevailed there a few months ago. The Cuban Government has discharged more than one-half of the Post Office employees, and these were experienced hands who knew how to handle the routine of the Department. Singularly enough, those who were retained are novices who have it all to learn. The result has been confusion. Many stacks of mail are waiting to be distributed, and there is no doubt but that in those heaped-up pouches are reposing numerous documents for merchants who are expecting shipments by incoming steamers. Should these clearance papers fail to be delivered by the Postal authorities to the merchants, the cargo, when discharged, must unavoidably accumulate on the docks until the necessary customs documents are received.

Foreign Pilferage Liability

SHIPOWNERS and operators will find much to interest them in the query and answer herewith referred to respecting the problem of how far the specific stipulations in a bill of lading (trans-oceanic shipment) may be regarded as null and void, if at all, owing to their infringement of the provisions of the Harter Act. Trade Commissioner Julian E. Gillespie recently submitted to the Division of Commercial Laws a case of disputed liability for pilferage which occurred in the port of Constantinople. The Division referred the matter for opinion to a firm of well-known admiralty lawyers of New York, the substance of whose reply is as follows:

It has been repeatedly held by our courts that the Harter Act applies to foreign vessels which come within the jurisdiction of American courts as well as to American vessels, provided the loss or damage complained of occurred on a voyage to or from a United States port. If the consignee takes delivery of his goods, any damage arising thereafter cannot be imputed to the ocean carrier. Although the question of liability for damage upon lighters at destination is constantly recurring, the effect of the Harter Act thereon, curiously enough, has never been passed upon by our courts. There are decisions holding where cargo is laden upon unseaworthy lighters hired by a steamship company and used to carry cargo to the vessel that the voyage first commenced when the cargo was laden on board the lighter, and the unseaworthiness of the lighters renders not only the owners of the vessel liable for the loss ensuing but also renders the vessel liable *in rem*.

Upon the same principle the legal advisers express the opinion that, if upon a vessel's arrival at destination cargo is laden upon lighters employed by the carrier for transportation to the shore, the steamship company is liable for a loss that arises either through the unseaworthiness of the lighter or through improper custody and care of cargo on the lighter, inasmuch as, in their judgment, the lighter is a substitute for the vessel to complete its contract of carriage. Bills of lading, it is true, almost invariably contain a provision that the steamship company or the vessel shall not be liable for loss arising after transshipment, "but we are of opinion," said the attorneys, "that the transportation of goods upon lighters does not come within the meaning of such a clause, as lighters are not really independent carriers but are merely auxiliary to the real voyage."

They also feel that inasmuch as a voyage has been declared by the courts to start when goods are laden upon a lighter provided by the carrier to carry the goods to the vessel (Bulkley *v.* Naumkeag Steam Cotton Company, 24 Howard 286), it would seem to follow logically that the voyage does not terminate until the goods are discharged upon the dock, at the termination of the voyage, where the carrier furnishes the lighter. Whether it be considered that the goods are still in transit or are in course of being discharged from the vessel, these attorneys maintain that the provisions of the bill of lading in reference to the liability of the steamship company for loss or damage to the goods while on the lighter are governed and limited by the provisions of the Harter Act.

Sections 1 and 2 of the Harter Act provide that a carrier cannot lawfully exempt himself by a provision in the bill

of lading from liability for loss arising from negligence or fault or failure in the proper custody, care or proper delivery of any lawful merchandise committed to his charge and that any such provision in a bill of lading shall be null and void and of no effect. It is the opinion of these attorneys that it should properly be held that the goods are still "committed to his (carrier's) charge" and are being "delivered" by him while the goods are on the lighter.

The final conclusion of this interesting opinion is as follows: "The inclusion in the bill of lading of a clause that the carrier shall have liberty to convey the goods upon lighters at the risk of owners is a provision rendered null and void by the provisions of the Harter Act (Section 1), and if loss or damage arises to the cargo on the lighters through unseaworthiness or through negligent care and custody of the cargo, the steamship company may be held liable therefor in a suit *in personam* and probably the vessel also held liable *in rem*."

Influence of the Greco-Turkish War

Underwriters are becoming increasingly wary about covering shipments to and from Asia Minor in view of the possible influences of the war between Greece and Turkey. Goods destined to either one of the belligerent countries are exposed to increased war hazards. Recently an important decision was handed down regarding liability for seizures of the property of the assured by de facto governments, and a considerable number of underwriters are now employing an altered war clause to conform to this requirement. De facto governments are not regarded as governments within the meaning of the clause. The new form is as follows, the italicized portions being the recent additions:

"Including direct loss and/or damage caused by strikers, locked-out workmen or persons taking part in labor disturbances, riots, civil commotions or explosions, the result of unlawful acts, but, notwithstanding anything to the contrary, either expressed or implied herein, or in the policy to which this endorsement is attached, this insurance does not cover and is hereby warranted to exclude claims for delay, deterioration or loss of market, or for confiscation or destruction by the Government, *and/or de facto Government*, of or within the country in which the property is situate and/or the Government, *and/or de facto Government of seceding or revolting States.*

Proposed State Law

At the meeting of the National Convention of Insurance Commissioners, held at Swampscott, Mass., on September 5-7, representatives of the American Institute of Marine Underwriters submitted a draft of the proposed uniform State marine insurance law as prepared by counsel to that body. It is largely based upon the new Marine Law of the District of Columbia, with certain alterations that should render it more acceptable to insurance men at large. The purpose is to have legislation of this character approved and advocated by the supervising authorities of the States, to the end that the conflicting requirements of the States may be smoothed out and American marine underwriters be afforded a uniform and scientific basis upon which to build up a business in keeping with the requirements of our new merchant marine. It is now up to the Committee on Laws and Legislation of the Insurance Commissioners. Of this important and essential legislative suggestion it may be said:

1. It has not been drafted in the interest of any particular State or group of States but as a practical and necessary aid to the development and advancement of the interstate and foreign commerce of the United States and the better to enable American shipowners, merchants and marine underwriters to meet world competition.

2. It has not been drafted in the interest of corporate insurers as distinguished from mutuals, inter-insurers or individual underwriters; its aim is to be fair to all and to provide equal opportunity for all.

3. The proposed State act does not intend to, nor does it, alter or restrict the complete control of the supervision, regulation or taxation of marine insurance by the States or by State officials.

It leaves untouched, or rather, it perpetuates, the supervisory powers of State commissioners of insurance. Its sole endeavor is to obtain substantial State uniformity of regulation and taxation in respect to a business which is of national concern and unique in character.

4. Its purpose is "to define, regulate and tax marine insurance," not to prepare an insurance code covering matters of substantive law as in the code States.

Shipping Destroyed in 1921

A report upon disasters to vessels during 1921 has been issued by *Lloyds Register*. It includes those that were lost at sea, broken up, condemned or otherwise removed from trade, and the grand total is 559 ships with a tonnage of 674,257. Of these, 344 were steamers and motor vessels, with an aggregate of 536,537 tons, and the balance sailing ships. Strandings and kindred casualties which are comprised under the term "wrecked" are the most prolific cause of disaster. To such casualties are attributable 45.16 percent of the losses of steamers and motor vessels and 38.8 percent sailing vessels. Cases of abandoned, foundered and missing vessels are, no doubt, frequently more or less similar in the circumstances of loss. If these be taken collectively, they form 30 percent of the steamers and motor vessels and 35½ percent of the sailing vessels removed from the mercantile marine during 1921, owing to casualty.

Of the 310 steamers and motor vessels totally lost, condemned, etc., during the year, 65 of 65,718 tons gross (0.34 percent of tonnage owned) were registered in the United Kingdom; 35 vessels of 42,332 tons (1.87 percent) in the British Dominions; 22 of 60,392 tons (0.45 percent) United States; 8 of 5,536 tons (0.63 percent) Denmark; 21 of 27,899 tons (0.85 percent) France; 12 of 7,005 tons (1.07 percent) Germany; 26 of 52,363 tons (8.92 percent) Greece; 2 of 602 tons (1.14 percent) Italy; 29 of 51,185 tons (1.53 percent) Japan; 16 of 28,210 tons (1.23 percent) Norway; 30 of 53,772 tons (4.84 percent) Spain; 8 of 9,693 tons (0.89 percent) Sweden; and the balance of 21 vessels owned in other countries.

As regards material of construction, 186 vessels of 360,449 tons were of steel; 45 of 46,206 tons of iron; 5 of 2,508 tons of ferro concrete; and 75 of 49,829 tons of wood and composite. Of the sailing ships totally lost, etc., out of the total of 193 vessels of 121,834 tons, 50 vessels of 46,753 tons were owned in the United States. The amount of tonnage broken up, dismantled, etc. (not in consequence of casualty) in 1921 was 93,431 tons.

International Oil Pollution Parley

Marine insurance men are naturally greatly interested in the official announcement from Washington to the effect that President Harding has authorized Secretary of State Hughes to enter into negotiations with the principal maritime nations of the world for a conference in the United States for a discussion of means of preventing oil pollution of navigable waters, especially in important harbors. No date for the parley has been intimated as yet. This action carries out a resolution adopted by Congress requesting the President to call such a conference. The State Department proposes at once to start an inter-depart-

mental inquiry along broad lines with the purpose of working out possible ways and means of solving this grave problem so far as this country is concerned. Every department of the Government using ships, the Shipping Board, Public Health Service, Biological Survey and the Bureau of Mines will participate in the inquiry. The problem involves finding a practical way to overcome the pumping out by tank steamers or oil fuel vessels of ballast water when nearing port, the ballast water having come from tanks which previously contained fuel oil and carrying with it into the sea a scum of heavy oil.

Japan Hull Risks

LONDON, during recent years, has been receiving a considerable amount of hull business from Japan, in the form of reinsurance of Japanese companies. Hitherto this business has gone exceedingly well but of late there have been complaints that the risks which are being sent are not of the best, while the rates paid are far from being satisfactory. The reinsurances are, for the most part, effected under a twelve-monthly contract and, although it is now too late to undo any harm that has been done, underwriters are keeping the matter under close observation for future regulation of their action.

Shipping Board to Conserve Coal

A FUEL Conservation Section, with headquarters at 45 Broadway, New York, has been established by the United States Shipping Board Emergency Fleet Corporation, according to Operations Order No. 16, issued by Joseph E. Sheedy, vice-president of the Emergency Fleet Corporation.

This Section is the active arm of the Fuel Conservation Committee and the specific duties entrusted to it are to make practical and technical studies of the methods of operation of vessels as regards their motive power and to suggest and promulgate means to improve these methods and consequently reduce the fuel bill of the Fleet Corporation.

This Section may require assistance of various kinds from time to time from other Departments in order to further its work. All Department officials and employees of the Corporation are requested to co-operate to the fullest extent in bringing about the desired results.

C. J. Jefferson is designated as Head of this Section and will be in active charge of its work.

The Fuel and Operating Departments of the Corporation will continue to function as heretofore in connection with the purchase, receipt and use of fuel.

©Keystone View Company, Inc., of N. Y.

Whaler Leaving New Bedford, Mass., for an Atlantic Voyage

The sailing of a whaling vessel from New Bedford Harbor, which years ago used to be a common sight, is now an unusual event. The above illustration shows the recent departure of the whaling bark Wanderer from this port for Cape Verde Islands to recruit a crew for an Atlantic whaling voyage, under command of Captain Joseph Edwards

The New 17,200-Ton Anchor Liner Tuscania

Latest Type of Present-Day Passenger Liner Practice Arrives in New York—Replaces Namesake Lost During War

ALTHOUGH there has been a large amount of passenger liner tonnage completed in English shipyards since the armistice was signed it is worthy of note that not one mammoth liner has been projected or designed. All of that type which have been put in service are simply completions of pre-war projects.

The Cunard Company has been the leader in the post-war practice of building vessels of the intermediate type of between 13,000 and 20,000 tons. These vessels, however, contain many of the comforts and conveniences that were formerly only to be found in the monster greyhounds. In other words, they are comfortable without being too luxurious and therefore adapted to the needs of the average pocketbook rather than that of the millionaire.

One of the latest vessels of this class to be completed is the *Tuscania,* which arrived in New York on September 27. The *Tuscania* was built for the Anchor Line (Henderson Bros.) service between Mediterranean ports and the United States and is fitted out in accordance with the emigrant regulations of Great Britain, Italy and the United States.

The Anchor Line practice of perpetuating the names of its vessels has been carried out in this case and the new vessel is named after an earlier *Tuscania* which was built in 1915 and lost during the war. The new vessel is slightly larger than her namesake and having more erections is also both wider and deeper, the gross tonnage being thereby increased from 14,348 to 17,200.

Main Particulars

The *Tuscania* is a twin screw passenger and cargo steamer and will be propelled at a speed of 17 knots by Brown-Curtis double reduction geared turbines of 13,500 shaft horsepower. She is of the same dimensions and generally similar to the recently completed *Cameronia* but has an additional deck amidships and consequently more space available for the accommodation of passengers.

The leading particulars are:

Length over all	578 feet 6 inches
Length between perpendiculars	550 feet
Breadth molded	70 feet
Depth to bridge deck	51 feet 3 inches
Load draft	28 feet 11¾ inches
Deadweight	about 10,700 tons

The vessel has been constructed under special survey to the Rules of the British Corporation, and is fully in accordance with the recommendations of the International Convention for the Safety of Life at Sea, a standard largely in excess of the present legal requirements as to sub-division. She is of the shelter deck type and has a straight stem and cruiser stern, and will be fore and aft rigged with two masts and one funnel. There are in all eight decks, viz.: lower, main, upper, shelter, bridge, lower promenade, upper promenade and boat deck.

Construction of Hull

The vessel is subdivided into eleven main transverse watertight compartments by ten watertight bulkheads, the fore peak bulkhead is carried up to the bridge deck while the others extend to the shelter deck. All watertight doors below the waterline are worked on the Stone-Lloyd system, also by gearing from the shelter deck. Fire resisting bulkheads with fireproof doors are fitted in the accommodation spaces above the shelter deck.

A double bottom is fitted all fore and aft between the peak bulkheads, and is utilized for carrying oil fuel, reserve feed water and water ballast. The fore peak tank is used for either fresh or salt water and the aft peak for water ballast.

Passenger Accommodations

The passenger accommodation is all situated above the main deck, the spaces beneath that deck being devoted to the carriage of cargo, ship's stores, machinery and bunkers. Three classes of passengers are carried and the accommodation is so arranged that a number of the rooms are interchangeable to either first or second class, the third class being berthed in open berths on the main and upper decks. The following are the numbers of passengers and crew for whom accommodation is provided:

First class	104
First interchangeable to second class	163
Second class	377
Third class (open berths)	1,818
Officers and crew	342
Total persons on board	2,804

The first class accommodation is all arranged on the lower promenade deck and consists of rooms for one, two and three passengers. The first and second class interchangeable rooms are mostly on the bridge deck, with a few on the shelter deck. These rooms accommodate from one to four passengers. The staterooms throughout are fitted with beds, settees, washbasins, dressing tables, wardrobes, and are complete with all furnishings necessary for the comfort of the passenger.

First Class Public Rooms

The first class public rooms, comprising dining saloon, lounge, writing room, smoking room, gymnasium and verandah cafe, are all large and airy apartments tastefully decorated and furnished. Their sizes are:

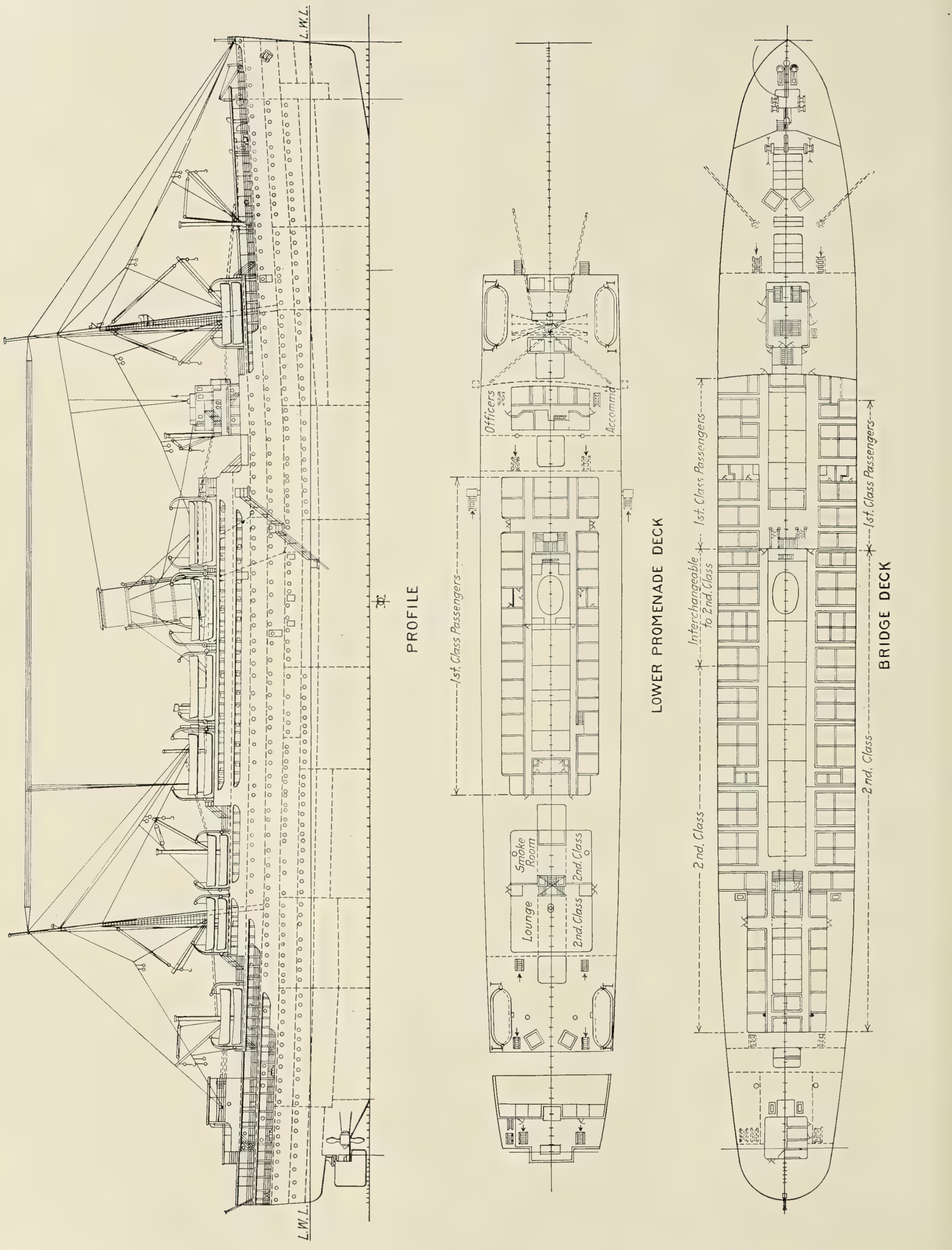
Dining saloon	52 feet by 68 feet by 8 feet 6 inches
Lounge	24 feet by 38 feet by 12 feet
Writing room	14 feet by 34 feet by 8 feet 6 inches
Smoking room	36 feet by 38 feet by 8 feet 6 inches
Gymnasium	14 feet by 29 feet by 12 feet
Verandah cafe	14 feet by 38 feet by 8 feet 6 inches

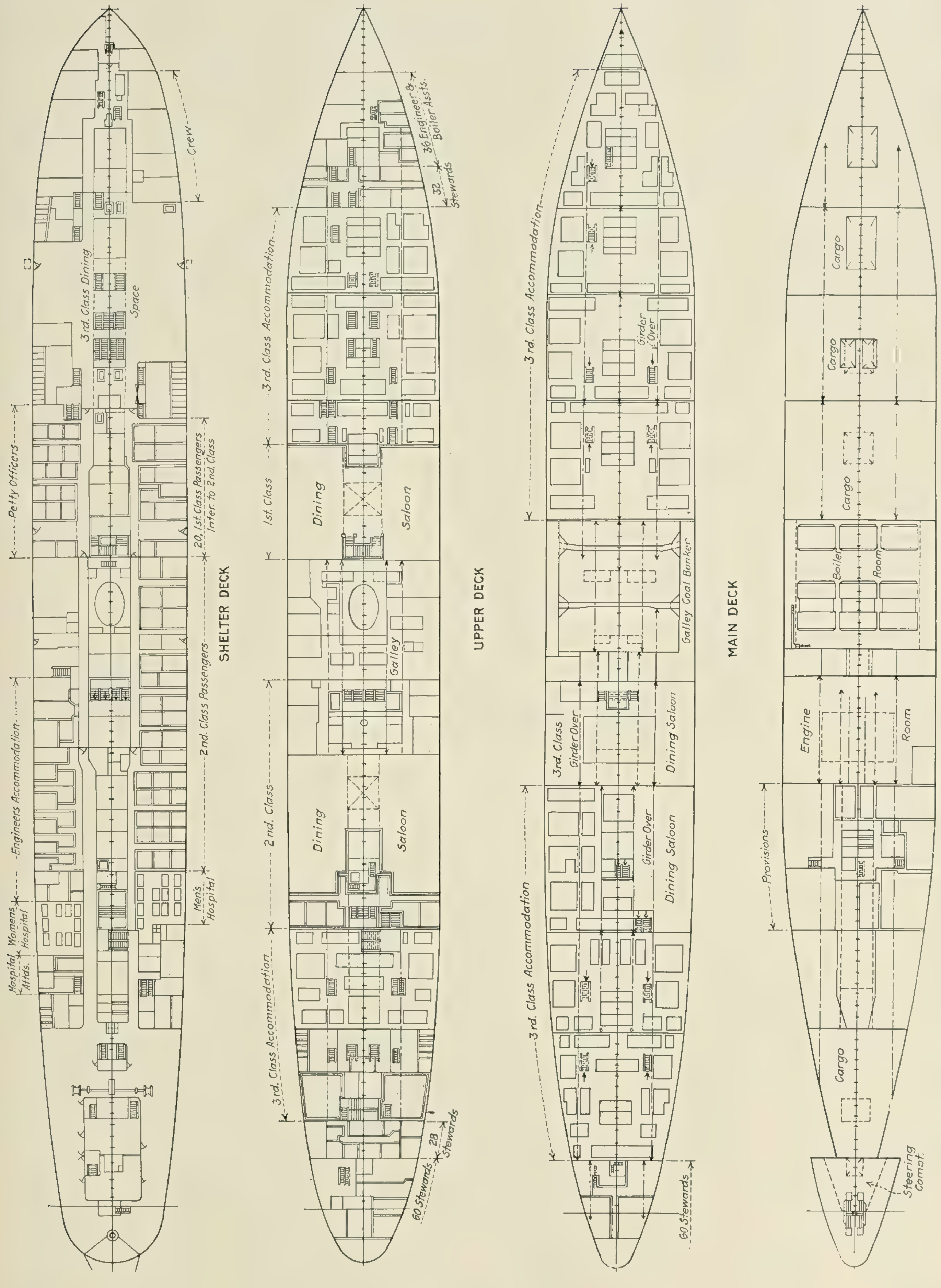
The dining saloon is situated on the upper deck and is entered direct by the main staircase. It occupies the full breadth of the ship and is surmounted by a large dome and musicians' gallery. Dining accommodation is provided for 158 passengers arranged at small tables accommodating from four to twelve persons, the floor area being about 20 square feet per person accommodated.

The remainder of the public rooms are in the deck house on the upper promenade deck. The lounge is at the forward end of the house just forward of the main stairway, the writing room alongside the funnel hatch, the smoking room between the funnel and engine hatches, the gymnasium aft of the engine hatch and the verandah cafe at the aft end of the deck house.

Second Class Accommodations

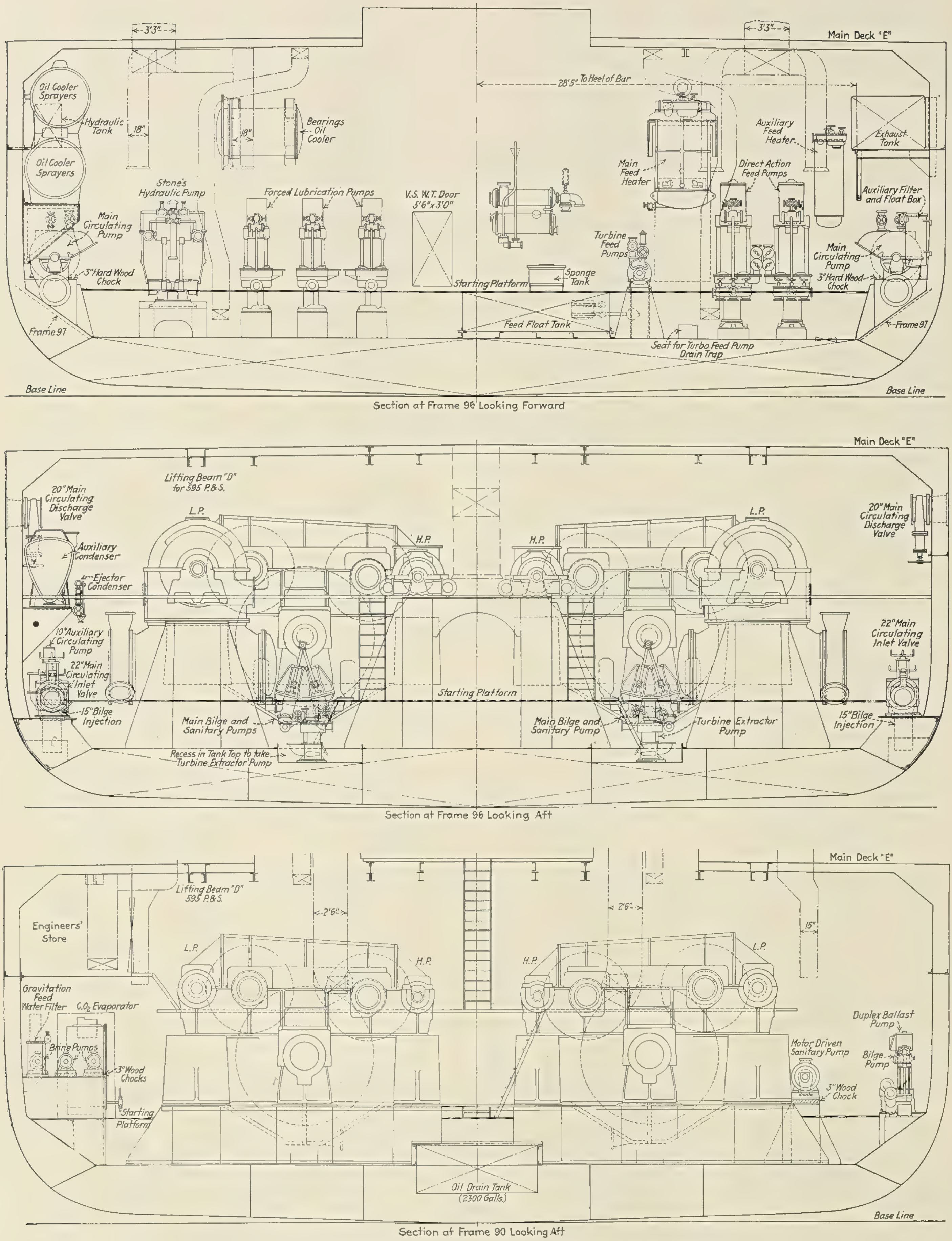
The second class public rooms include a dining saloon, lounge and smoking room. The dining saloon, 64 feet by 68 feet, is on the upper deck and has dining accommodation for 256 people. This can be increased to 272 by extending some of the tables, the floor area being then 18 square feet per person. The tables are arranged to accommodate from


L.W.L.
L.W.L.
PROFILE
Officers
Accomm
1st. Class Passengers
Smoke Room
2nd. Class
Lounge
2nd. Class
LOWER PROMENADE DECK
1st. Class Passengers
Interchangeable to 2nd. Class
2nd. Class
1st. Class Passengers
2nd. Class
BRIDGE DECK

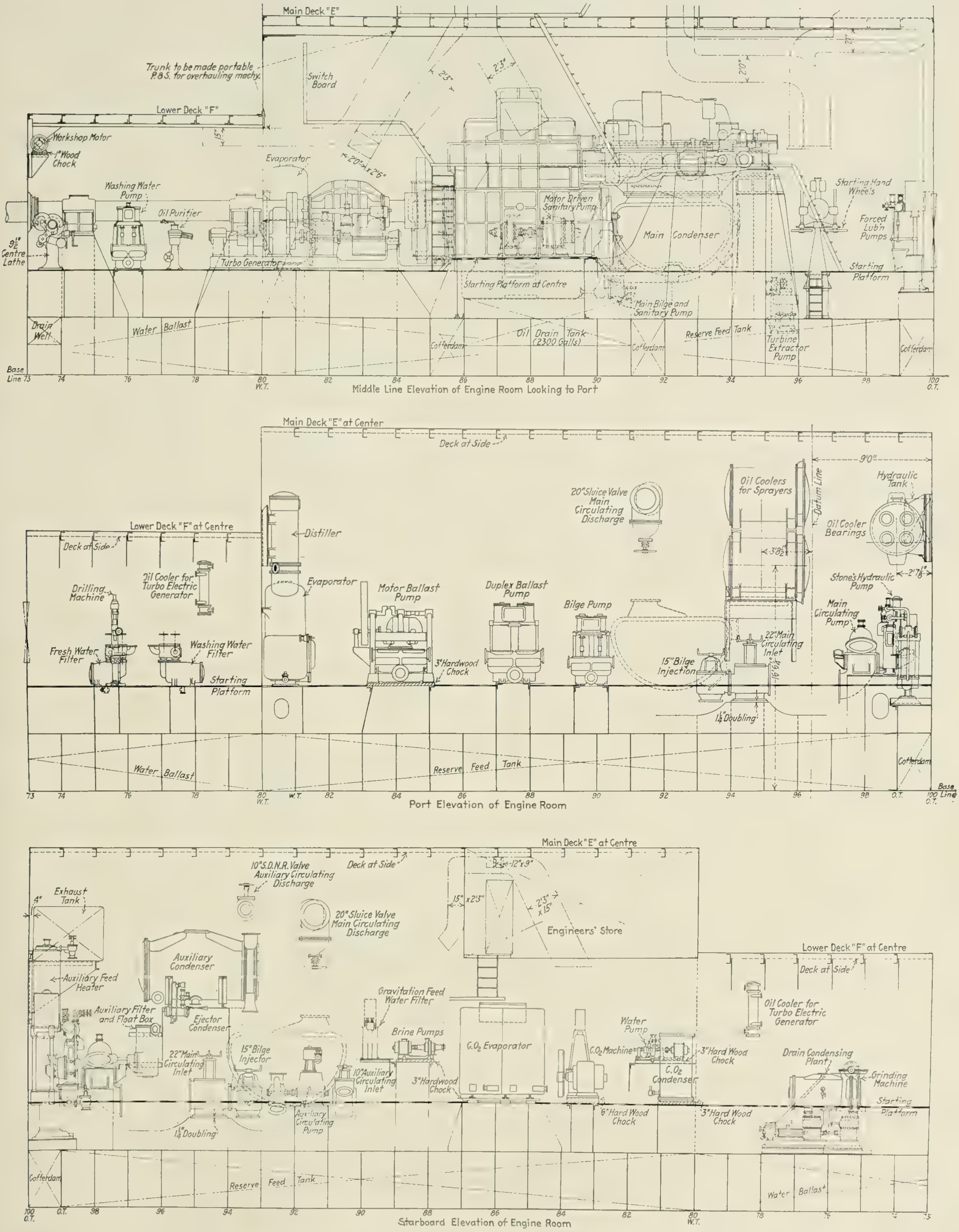


LOWER DECK

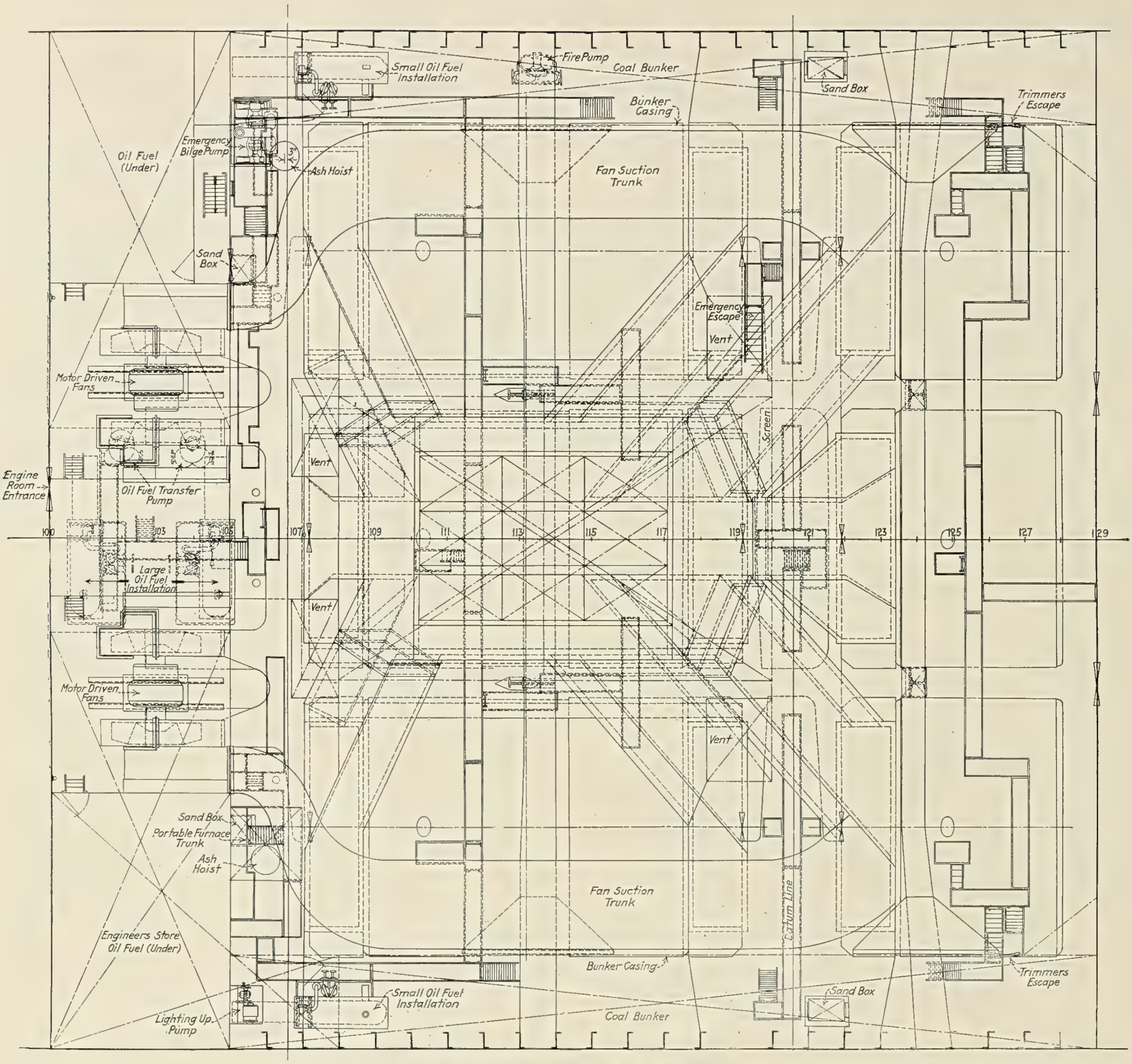
Profile and Deck Plans, S. S. Tuscania



Transverse Sections Through Engine Room, S. S. Tuscania



Longitudinal Sections Through Engine Room, S. S. Tuscania



Plan of Boiler Room, S. S. Tuscania

two to fourteen people. The lounge and smoking room is situated in a deck house on the lower promenade deck with the main second class stairway between them. These rooms are furnished with comfortable chairs, sofas and settees. A piano is placed in the lounge and a bar arranged in the smoking room.

Third Class Accommodations

The third class passengers are berthed in open berths on the upper and main decks. Dining spaces are arranged on the main deck amidships and on the shelter deck forward. Smoking rooms and sitting rooms are provided on the upper and shelter decks aft.

Ample open and covered promenading spaces have been allotted to each class of passengers.

Careful attention has been given to the accommodation for the officers and crew of the vessel. The captain's rooms are on the bridge, officers on the lower promenade deck, engineers, petty officers and seamen on the shelter deck, firemen and stewards on the upper and main decks. Separate mess and recreation rooms have been provided for seamen, firemen and stewards.

The culinary department for the passengers and crew are replete with all the necessary equipment and fittings. The passengers' galley is placed on the upper deck between the first and second class dining saloons and the crew's galley is forward on the shelter deck.

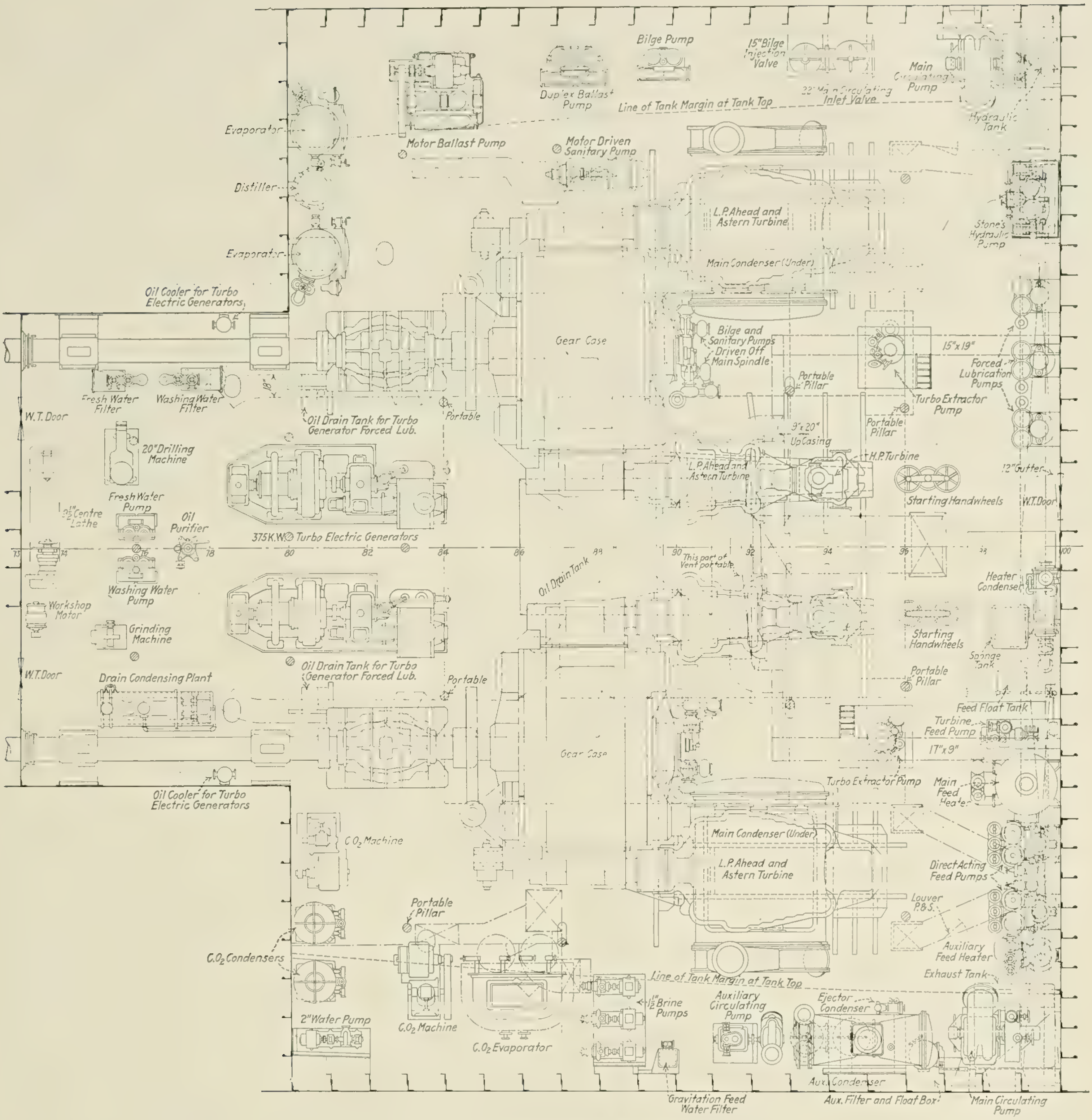
The lifesaving equipment is sufficient to meet the requirements of all on board and is in accordance with the provisions of the International Convention on Safety of Life at Sea. The boats are placed under fourteen sets of davits of the "Welin" type.

Heating and Ventilation

The sanitary arrangements are of the most modern description and four distinct water services are provided. The first and second class accommodation, officers and petty officers rooms are heated by steam radiators while the third class and crew's quarters are heated and ventilated by the thermotank system.

Deck Machinery

As the vessel has a large cargo carrying capacity special attention has been paid to the appliances for rapidly handling



Plan of Engine Room, S. S. Tuscania

the cargo. Fourteen derricks are fitted each capable of supporting five tons; these are operated by means of electro-hydraulic winches.

All the deck machinery, including the windlass, is electrically operated. The steering gear, which is placed on the lower deck, is of the Hele-Shaw type, operated by telemotor gear from the navigating bridge.

Electrical Plant

A complete electrical installation is fitted throughout the ship. The generators consist of three sets of engines coupled to three dynamos, each of which is capable of giving an output of 100 kilowatts at 110 volts. In addition to these an emergency dynamo and engine is fitted in a deckhouse on the bridge deck.

A patent fire extinguishing system is fitted throughout the ship.

Insulated and other stores are placed aft on the lower deck. The refrigerating machinery for the insulated stores is of the CO_2 type and is placed in the engine room.

A wireless installation is installed to meet the requirements of the Italian Laws.

The deck covering throughout all accommodation is of Teakoid and in all lavatories and galleys Terrazzo tiling. Weather decks, where exposed, are laid with pitch pine.

Propelling Machinery

The propelling machinery consists of two sets of Brown-Curtis turbines, driving twin screws through double reduction gearing. Each set comprises three turbines, a high pressure and an intermediate pressure turbine being coupled together in tandem driving one first reduction pinion of the gearing, and a low pressure turbine driving the other first reduction pinion. A high pressure astern turbine is incor-

porated in the same casing as the intermediate pressure ahead turbine, and a low pressure astern turbine is incorporated in the same casing as the low pressure ahead turbine.

Boilers

Steam is generated in 3 double ended and 3 single ended boilers of the cylindrical return tube type, installed in one boiler compartment and designed for a working pressure of 220 pounds per square inch, superheaters being fitted capable of superheating the steam 200 degrees at the turbines. There is a complete installation, in duplicate, for burning oil fuel on the Howden-Wallsend system and provision is made for readily converting the boilers to coal burning if so desired at a later date.

Auxiliaries

In place of the usual air pumps, etc., for maintaining the vacuum and dealing with the feed water, Weir's patent "closed feed" system will be fitted, rotary water extractor pumps and air ejectors taking the place of the air pumps.

A special condensing plant is fitted in connection with the ship's heating system to ensure a perfect control of the temperature in the accommodations, while the more important of the auxiliary engines in the engine room, such as sanitary and ballast pumps, are fitted in duplicate, one of each being arranged for steam and one for electric power drive.

S. S. Steelore Launched at Sparrows Point Shipyard

The S. S. *Steelore,* a 20,500-ton turbine driven freight vessel, was launched at the Sparrows Point Plant of the Bethlehem Shipbuilding Corporation, Ltd., on August 15. She is owned by the Ore Steamship Corporation of New York, being the last of three vessels of this capacity and same general type to be built for this company recently at Sparrows Point.

The *Steelore* is arranged for carrying iron ore and when completed will be put into service for the transportation of ore from South America to the United States. She is of the same size and similar in construction to the *Bethore,* the large combination ore-and-oil vessel recently delivered at Sparrows Point to the Ore Steamship Corporation, but will be propelled by two Curtis-type turbines with Falk single reduction gears instead of by reciprocating engines.

The principal particulars of the *Steelore* are as follows:

Length, overall	571 feet 6 inches
Length, between perpendiculars	550 feet 1 inch
Breadth, molded	72 feet
Depth, molded	44 feet
Draft, loaded	32 feet 4 inches
Deadweight capacity	20,500 tons
Speed	11½ knots
Turbines	Curtis with single reduction gear
Type of boilers	Single end, Scotch
Number of boilers	3
Size of boilers	17 feet 6 inch diameter by 12 feet long
Kind of fuel	Oil
Type of oil burning equipment	Bethlehem (Dahl)

Japanese Electrically Propelled Naval Vessel Has Successful Sea Trials

The *Kamoi,* a 20,000-ton, 8,000 horsepower twin screw fuel ship of the Imperial Japanese Navy, and the first vessel of any navy other than the United States to be electrically propelled, successfully completed the builders' trials off the Delaware Capes on September 8. For thirty-six hours the *Kamoi,* manned by a crew from the yard of her builders, the New York Shipbuilding Corporation, and a Japanese crew under command of Captain T. Murase who will later take her over, was put through tests that brought into play every possible stress on all parts of her machinery and equipment and showed no signs of weakness.

First Installation of Synchronous Motors on Twin Screw Vessel

The electric drive equipment of the vessel, designed and installed by the General Electric Company, includes the use of synchronous motors for the first time in any twin screw vessel. Tests demonstrated that the Japanese ship is the most economically operated steam vessel of her size afloat. Her electrical propelling machinery gives unusual flexibility of control as well as economy of operation, and the mechan-

Launching of S. S. Steelore at Sparrows Point Plant of Bethlehem Shipbuilding Corporation, Ltd.

Japanese Fuel Ship Kamoi Leaving the Builder's Yard for Her Sea Trials

ical simplicity of the driving unit affords exceptional reliability.

There is practically no vibration to the vessel as was shown by the balancing of a nickel on edge on the foundation of the main turbine while the ship was under way. While the ship was going ahead at full speed the propelling machinery was reversed to ¼ speed astern in 19 seconds, after which the engines were brought up to full speed astern.

The *Kamoi* was built in this country instead of in the large shipbuilding yards of Japan in order that the Japanese might get electric drive which has been so highly developed in the United States on commercial and naval vessels.

Details of Machinery

The main propulsion unit consists of an 8,000 horsepower Curtis turbine generator, supplying power to two 4,000 horsepower synchronous motors directly driving the twin screw propellers. There are also two 400 kilowatt direct current turbine generators which supply the excitation current as well as power to operate the auxiliaries such as the main circulating pump, main condensate pump, sanitary pump, blower motors, steering gear, radio apparatus, ventilators and lighting equipment.

There is also a 625 kilowatt auxiliary alternator which can be connected to either of the auxiliary turbines in case of the failure of the main driving unit or any of the auxiliaries. This small generator will supply sufficient power to propel the ship at a speed of about seven knots.

The vessel is a coal burner, equipped with four Yarrow type boilers which have oil spray boosters attached to be used when high temperature is desired quickly.

Radio Equipment Is Unusual

The radio equipment is also of General Electric manufacture, consisting of a one kilowatt telephone and telegraph transmitter and two complete receiving sets, one with a range of 250 to 3,000 meters and the other from 250 to 30,000 meters. An unusual feature of the telephone installation is five extensions from the radio room connecting with the captain's cabin, engine room and other parts of the ship. By means of this equipment the captain can remove the receiver from the 'phone at any one of five stations and put in a call for the officer of another ship and carry on a conversation by radio much as he might from an office on a land telephone.

The ship has a normal tonnage of 19,500, is 495 feet long and has a beam of 62 feet. She has a draft of 28 feet and is equipped to carry approximately 10,000 tons of fuel oil.

Dock trials were held at Camden on August 25 and proved most satisfactory. After informal receptions on board the ship at Philadelphia and New York the *Kamoi* will proceed to Norfolk to take on fuel and will leave later on its trip to Japan.

Geared Turbine Cargo Steamer Built on the Wear for Dutch Owners

One of the latest vessels completed by The Wear Shipyard of William Gray and Company (1918) Limited, West Hartlepool and Sunderland, is the finely modeled geared turbine steamer *Modjokerto* built for Rotterdamsche Lloyd (William Ruys & Zonen, Directors, Rotterdam). The vessel was launched on February 27 of this year and successfully completed her sea trials on July 20.

The leading particulars of the vessel are as follows:

Length overall	451 feet 0 inches
Length on load waterline	449 feet 9 inches
Length between perpendiculars	433 feet 0 inches
Breadth, extreme	57 feet 3 inches
Breadth, molded	57 feet 0 inches
Depth, molded (to upper deck)	32 feet 10 inches
Depth to shelter deck	41 feet 0 inches
Load draft	29 feet 10¾ inches
Load displacement	16,436 tons
Load displacement coefficient	0.783
Tons per inch at load waterline	51.55
Deadweight tonnage (cargo and bunkers)	11,416
Under deck tonnage	6,181
Gross tonnage	8,404
Net tonnage	5,350

The vessel is of the shelter deck type without tonnage opening, and has been built under special survey to take the highest class of Lloyd's Register of Shipping. The Dutch Board of Trade Laws have also been complied with.

Although the vessel is built on the usual double bottom construction, several of the double bottom tanks have been specially constructed for the carriage of oil fuel. Heating coils have been fitted around the suction pipes in these

tanks to liquefy heavy oil. A deep tank of over 1,000 tons capacity is arranged directly abaft the engine room for the carriage of cocoanut oil, and a deep tank of similar capacity is provided immediately forward of the boiler room for the carriage of oil fuel. Side bunkers are also arranged for the carriage of oil fuel.

Accommodation is provided for the officers and engineers in steel houses built abreast the machinery casing, and a large steel house is arranged abaft No. 2 hatch, in which is the dining saloon and 5 staterooms. The captain's day and sleeping cabins, the wireless room and the wireless operator's cabin are situated over the dining saloon, and the chart house is fitted on top of the captain's house.

For the rapid handling of cargo, 14 steam winches by Messrs. Clarke, Chapman & Company, Ltd., Gateshead, are provided to work 14 derricks. A heavy derrick to lift 30 tons is stepped on the shelter deck directly abaft the foremast, and provision is also made directly forward of the mainmast for the transposing of this derrick.

The windlass is arranged to take a 2⅜ inch cable, and is of a very powerful type, the makers being Messrs Clarke, Chapman & Company, Ltd. The steering gear is of the Wilson-Pirrie type by Messrs. Hastie & Company of Greenock, and is operated by telemotor from the bridge.

An up-to-date electrical installation has been fitted throughout the vessel by the builders. Current is supplied at 65 volts by two dynamos of 16½ kilowatts capacity each, located in the engine room. The engine room auxiliaries are supplied by the Central Marine Engine Works.

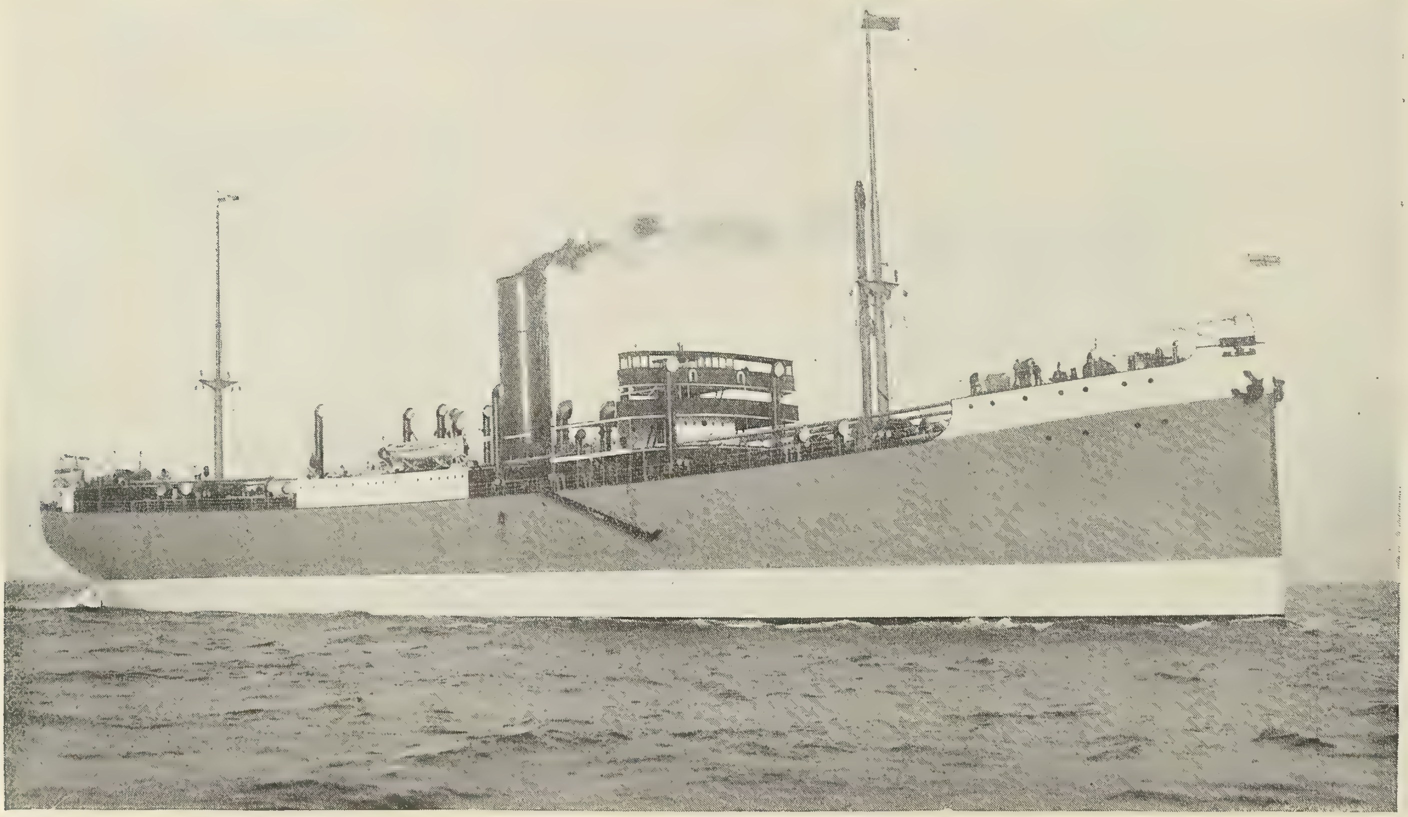
The propelling machinery, supplied by the Central Marine Engine Works, West Hartlepool, consists of one high pressure turbine of the impulse type, and one low pressure turbine of the reaction type, independently connected through flexible couplings to a set of double reduction gear wheels, which drive a four-bladed bronze propeller through a single line of shafting. Astern turbines, capable of developing 70 percent of the ahead power, are contained in the casings of the two ahead turbines.

Steam is supplied by four multitubular boilers, working under Howden's system of forced draft at a pressure of 225 pounds per square inch, and having a superheat of about 100 degrees F. The boilers are specially designed for burning coal or oil fuel.

Wrought Iron Produced by Mechanical Methods

Because of its desirable corrosion-resisting properties and resistance to vibratory stresses, wrought iron has always been in great demand industrially, its use being limited only by the output. The excessive labor and cost of hand puddling has largely been responsible for this condition, to overcome which many types of mechanical puddling furnaces have been designed at various times. The latest development in this connection is an oil-fired electrically operated furnace, which, working in conjunction with a new Titan rotary squeezer makes up the Titan process of wrought iron production, as carried out by the Titan Iron and Steel Company, Inc., Newark, N. J.

Physical, chemical and microscopic laboratory tests of wrought iron worked by this process indicate that all the desirable properties of hand-puddled wrought iron are retained and that the uniformity of structure is increased. In addition, the distribution of slag contained is more uniform, thus insuring maximum protection against rust and corrosion. Metallurgically, the Titan mechanical process of puddling is practically the same as the old hand process; that is, the stages of clearing, boiling, dropping and balling are carried on in a similar manner in both processes. The new type squeezer makes possible the removal of the correct amount of excess slag from the larger mass of wrought iron produced in the mechanical puddle furnace in one heat. Oil firing is an advantage in the process as well and makes possible quantity production of the metal on an economical basis.



Geared Turbine Cargo Steamer Modjokerto

Reconditioned Steamship H. F. Alexander Leaving the Sun Shipyard

Passenger Accommodations of the H. F. Alexander

U. S. S. Columbia, Formerly Army Transport Great Northern, Reconditioned at Sun Shipyard for Admiral Line Passenger Service

FEW vessels in the American merchant marine have had a more varied or interesting career than has fallen to the lot of the 23-knot, triple screw passenger steamship *Great Northern,* which, with her sister ship, the ill-fated *Northern Pacific,* was built eight years ago by the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa., for the San Francisco-Astoria service of the Spokane, Portland and Seattle Railway Company, a subsidiary of the Great Northern Railway Lines. She is the largest direct turbine-driven passenger vessel built in the United States and with the graceful lines of her hull, ample freeboard and well-protected decks provides the qualities of speed, strength and seaworthiness so desirable for the fast coastwise service for which she was originally designed.

With the entrance of the United States into the World War the *Great Northern* was called into service as an army transport and carried upwards of 35,000 men to the battlefields of Europe, making round trips in a fraction over twelve days. After the war the vessel was again in service in Pacific waters for a brief period after which she was taken over by the Navy, rechristened the *Columbia* and used as the flagship of the Atlantic fleet. On March 2 of this year the *Columbia* was brought to the yard of the Sun Shipbuilding Company at Chester, Pa., by the Admiral Line to be reconditioned as a first-class passenger liner for the coastwise service of her new owners between Seattle, Wash., and San Pedro, Cal.

Within ten weeks the transformation of the vessel was complete, the work involving the complete rebuilding of her four principal decks. Two hundred and fifty-four staterooms were built, with their fittings, together with about fifty special de luxe suites, officers' quarters, dining room, lounge, new heating and ventilating systems and many other changes. Some idea of the nature of this work can be gained by an inspection of the interior views of the *H. F. Alexander,* as the vessel is now named in honor of the president of the Admiral Line, which are reproduced on the following pages through the courtesy extended by the Sun Shipbuilding Company.

Plans for reconditioning the vessel were furnished by Theodore E. Ferris, naval architect, New York, who personally supervised the work. On the "A" or promenade deck, which is flush from the stem to a point near the stern, are the main public rooms including the lounge, observation room, music room, main lobby, smoking room and deck veranda. On the deck below is a woman's writing room while the main dining room, with galley, pantry, etc., is located on the upper deck. The style of decoration and furnishing in the public rooms is varied and pleasing, each being especially adapted for its purpose. In the lounge, smoking room and the owner's suite fireplaces form an attractive feature of the furnishings.

General Characteristics of Vessel

With her commodious and luxurious accommodations the *H. F. Alexander* offers the most modern facilities for swift transportation by water along the Pacific coast. The vessel has a length overall of 524 feet and between perpendiculars of 500 feet. Her beam is 63 feet and her depth to the promenade deck 50 feet 8 inches. She has a deadweight carrying capacity of 2,185 tons on a draft of 21 feet. Her gross tonnage is 8,255 tons. Propulsion is by Parsons turbines arranged on three shafts, the high pressure turbine driving the center shaft and the low pressure turbines the wing shafts. At her designed speed of 23 knots the propellers turn at 325 revolutions per minute. Steam is supplied at 220 pounds per square inch by 12 oil-fired Babcock and Wilcox watertube boilers working under the closed stoke hold system of forced draft.

Additional Repairs Required

Just after the *H. F. Alexander* had been turned over to the Admiral Line and was on her way to New York, preparatory to her sailing for her station on the Pacific coast, the vessel was in collision with the British steamer *Andree* causing extensive damage to her bow. Returning to the Sun yard on May 22 the ship was placed in drydock for repairs. The damage both above and below the waterline was so extensive that it was necessary to replace a considerable portion of the stem and main keelson and twenty-seven frames and plates. The work was rushed day and night without interruption and on May 29, two days ahead of the scheduled time, the job was completed and the vessel was ready to take on her fuel oil and resume her service.

Interior Views of H. F. Alexander: (1) Observation Room, (2) Smoking Room, (3) Music Room, (4) Dining Room

Interior Views of H. F. Alexander: (5) Lobby Entrance, (6) Parlor of Owner's Suite, (7) Stateroom de Luxe and Bath, (8) Owner's Bedroom

The Golden Gate, Which Runs Between San Francisco and Sausalito in San Francisco Bay, Is the First Diesel Engine Electric Ferryboat to Go Into Operation

Electric Drive Adopted in a New Field

Application to Double Ended Ferryboats—Types of Installation, Power Requirements and Advantages Described

By W. H. Wild*

THE effective service rendered in recent years by electrically propelled vessels of many different types and sizes is one of the chief factors which has just led to the extension of the system into a new field—the double ended ferryboat. News dispatches have announced the placing of several orders for electric equipment for boats of this class in New York and San Francisco, and one of the vessels went into service in the harbor of the latter city this summer. There are now seven ferryboats either running or in process of building, utilizing both the Diesel engine and turbine electric method of propulsion. Three boats have been contracted for in New York with turbine electric drive and four in San Francisco equally divided between Diesel engine electric and turbine electric drive.

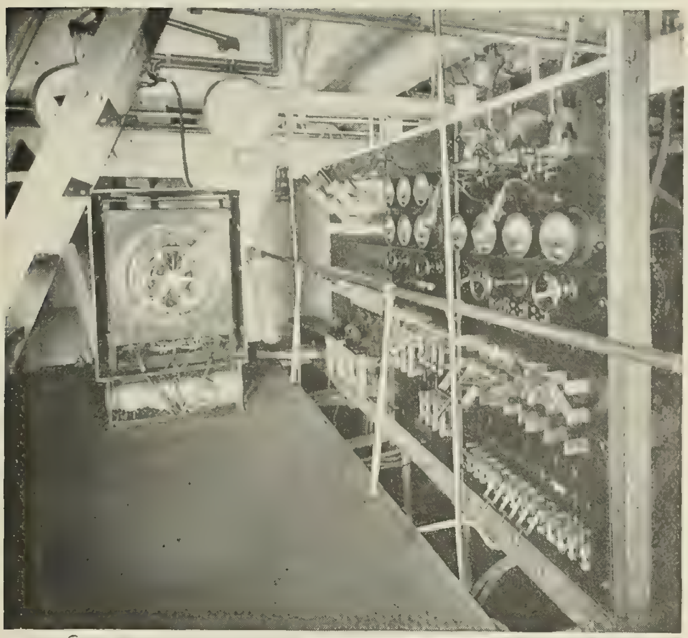
Intended for Fast Service

The San Francisco boats are intended for fast service across the Bay, being 220 feet long, overall, and equipped with two 500 horsepower Werkspoor Diesel engines, each driving a 360 kilowatt, 250 volt direct current generator. The power from the generators is delivered to two 750 horsepower, 500 volt shunt wound motors, one on each propeller shaft. The New York Harbor boats are much larger, and will run between Staten Island and New York City. Their propulsion equipment consists of one 2,200 shaft horsepower, 2,300 volt, 3 phase turbine generator supplying power to two 2100/100 shaft horsepower, 2,300 volt, 3 phase induction motors, one on each propeller shaft. Both types of boat are designed to give rapid service on runs about five miles in length.

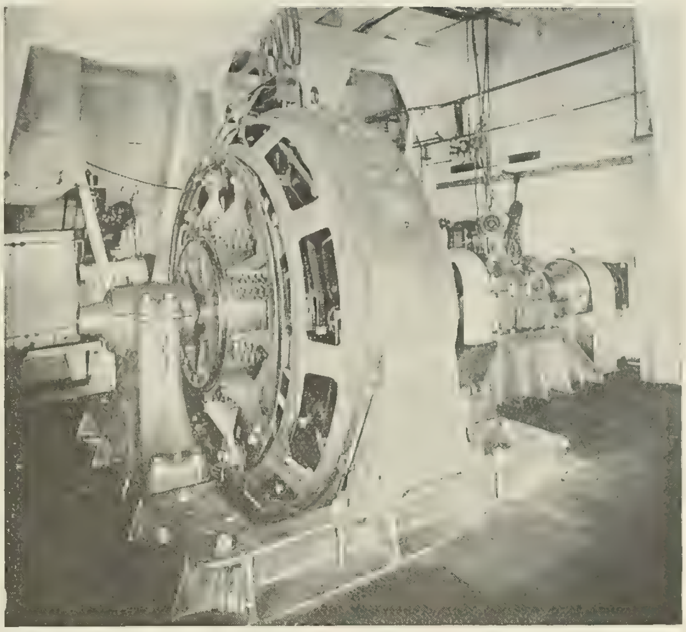
The dominating idea behind the application of electric drive in both instances was to give rapid and efficient service with the greatest economy possible. The performance of various ocean going ships equipped with both classes of electric drive have demonstrated its superiority on a number of counts. Among the most important of these are reduced fuel consumption, better maintenance of the desired speed under varying conditions and increased maneuvering ability. All of these are of equal importance in the case of ferryboats, especially those operating on runs of considerable distance through crowded harbors where strong current may be encountered.

Tests conducted over the past twenty years on double

*Marine Department, General Electric Company, Schenectady, N. Y.



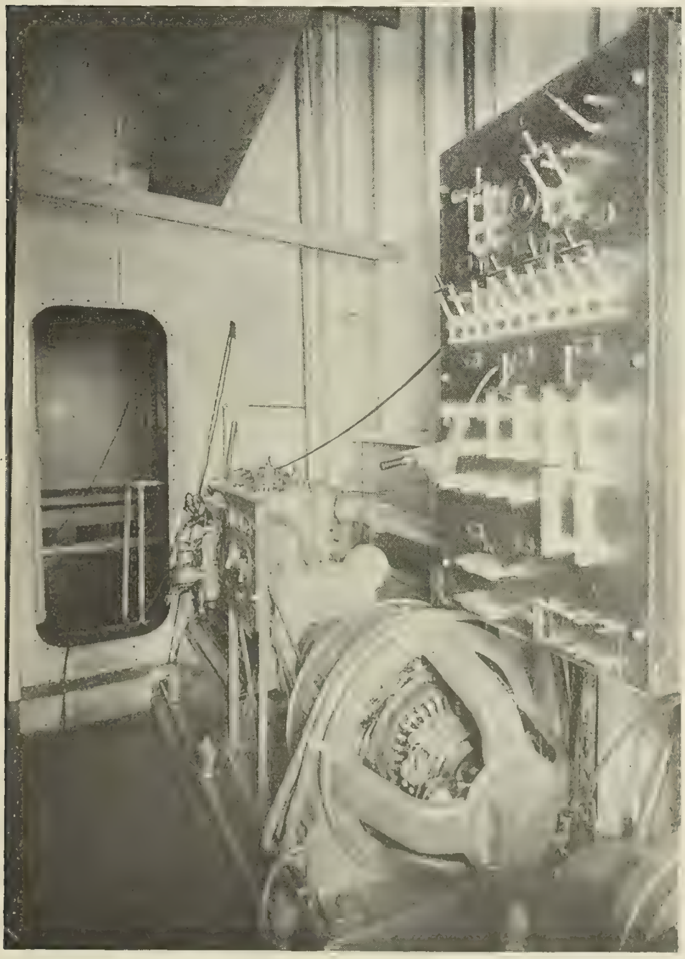
Switchboard Gallery in the Engine Room, Showing Control and Meter Panels and Control Rheostat, on the Golden Gate



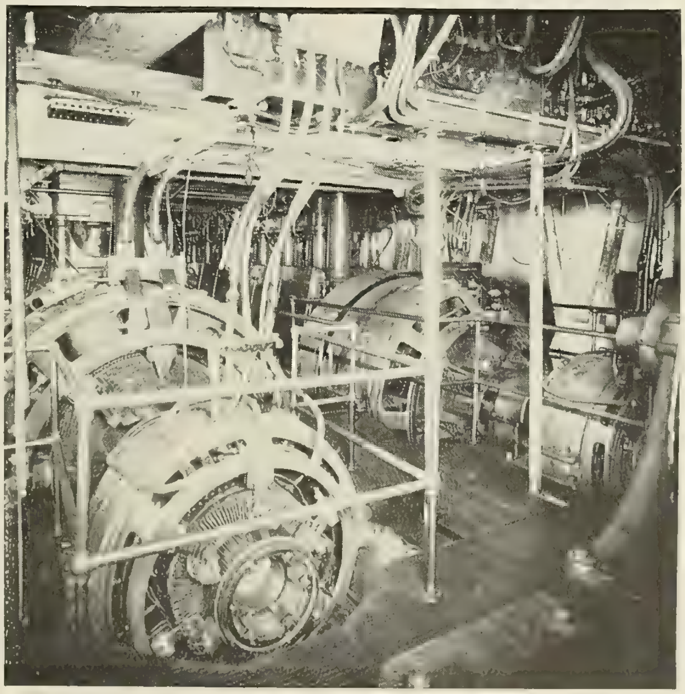
One of the Golden Gate's 750 Horsepower, 500 Volt, Shunt Wound, Direct Current Propeller Motors. Two of These Are Installed, One at Each End of the Engine Room

ended ferryboats have established two salient facts in connection with their design and operation. First they must have propellers fore and aft, both for maneuvering, and changing direction quickly, and second, the most efficient method of propulsion is by means of the stern propeller. Until the inception of electric drive, the problem of how to effect the concentration of power on the stern propeller remained without a really satisfactory solution. The basis for such a statement is the result of tests made on steam ferryboats, which showed high percentages of power loss, due to the bow propeller. As a result, in most cases the boats had to be "overpowered" considerably in order to insure the desired speed and maneuvering ability.

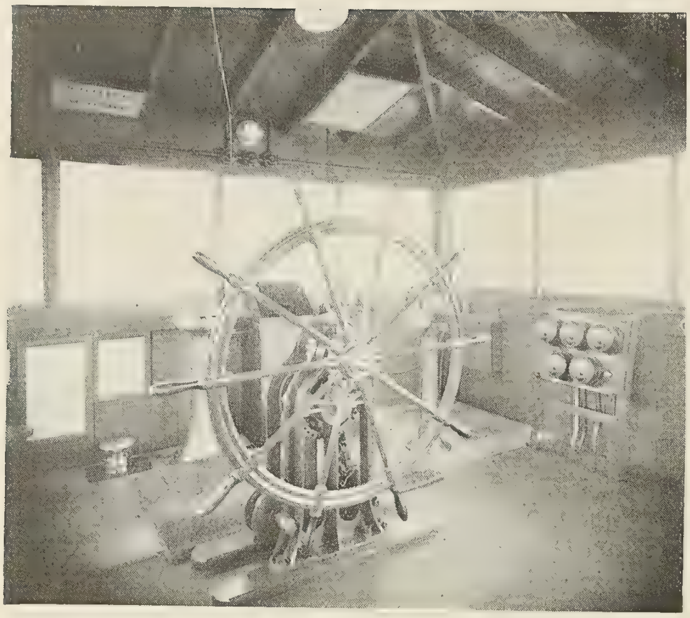
On the other hand, the flexibility of electric drive makes the solution of the power concentration problem comparatively simple. By using two motors, each individually con-



One of the Diesel Engine Driven Auxiliary Generators on the Golden Gate Which Supply Power for the Pumps, Current for Lighting, etc.



Engine Room of the Golden Gate, Showing the 500 Horsepower Werkspoor Diesel Engines and 360 Kilowatt, 250 Volt, Direct Current Generators and Exciters Which Supply Power to the Propelling Motors

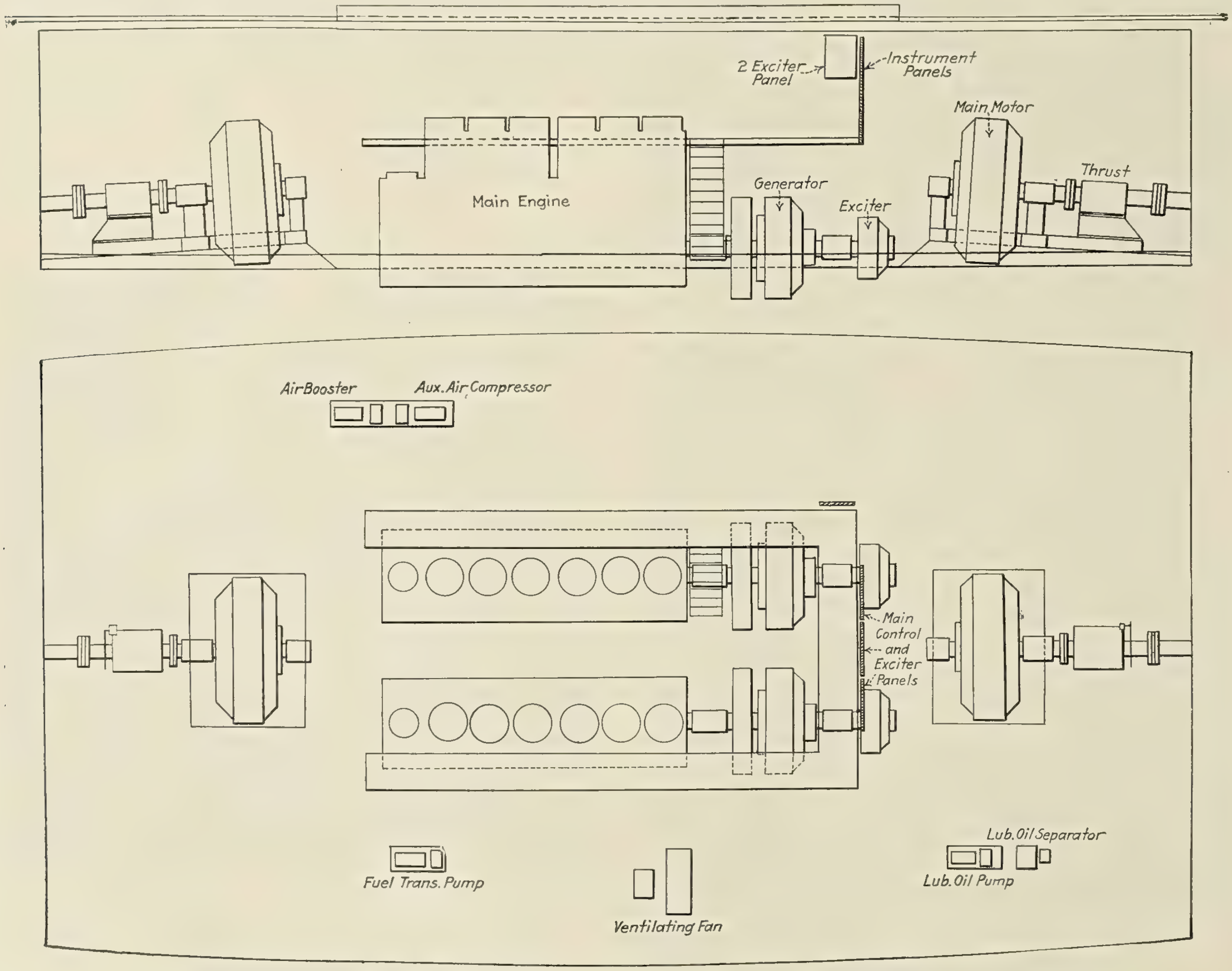


Interior of Pilot House of the Golden Gate, Showing the Steering Wheel and the Pilot House Meter Panel

nected to one of the propellers by a short shaft, and mechanically independent of each other, the power can be distributed and concentrated where it is needed, and any speed or direction of rotation obtained on either propeller, irrespective of that of the prime mover, be it turbine or Diesel engine. Furthermore, the bow propeller can be turned over at such a speed that the power saved in driving it electrically is about equal to the total electric losses. This fact was demonstrated by a series of tests, described in the December, 1920, issue of Marine Engineering and Shipping Age by Commander S. M. Robinson, U. S. N. On the Diesel engine electric ferryboats this "pilot motor" speed is obtained by strengthening the field of the forward motor. After the proper speed has once been found, it can be made the subject of an automatic setting through the control panel. On the turbine electric boats, the induction motors driving the propellers are designed for operation with two sets of poles, provision for shifting from one to the other being made in the control panel.

Maneuvering Ability Increased

Of the other features mentioned in connection with electric drive, the one of next importance in ferryboat practice, is probably maneuvering ability. Such a boat, operating as it does in crowded harbors, must be under absolute control, not only as regards forward speed, but for stopping and reversing. With electric drive, since only the speed of the motor must be altered, stopping and reversing are both only a matter of seconds as has been thoroughly demonstrated in the case of the electric ship. In addition, the control may be located in the most advantageous position—in the pilot house itself, if desired, so that the ease with which the boat



Longitudinal Section and Plan of Engine Room of San Francisco Diesel-Electric Ferryboat

may be handled in emergencies is greatly increased. Maneuvering ability is also a decided asset in boats that are required to dock as rapidly and smoothly as are ferryboats.

The character of the propelling apparatus and the method of connecting the actual driving elements to the source of power are such that not only can the units be mounted so as to conserve the greatest amount of space, but so as to give the greatest of efficiency as far as power is concerned, since the power is applied just where it is needed. It also facilitates the use of electrically driven auxiliaries of various sorts, and the electric auxiliary is even more efficient on ships operating on an intermittent duty cycle than it is on cargo ships. All things considered, it is a safe prediction that the success experienced by the electrically driven ship will be equalled by that of the electrically driven ferryboat, and that the number of the latter will increase rapidly, as the realization of their advantages becomes more widely spread.

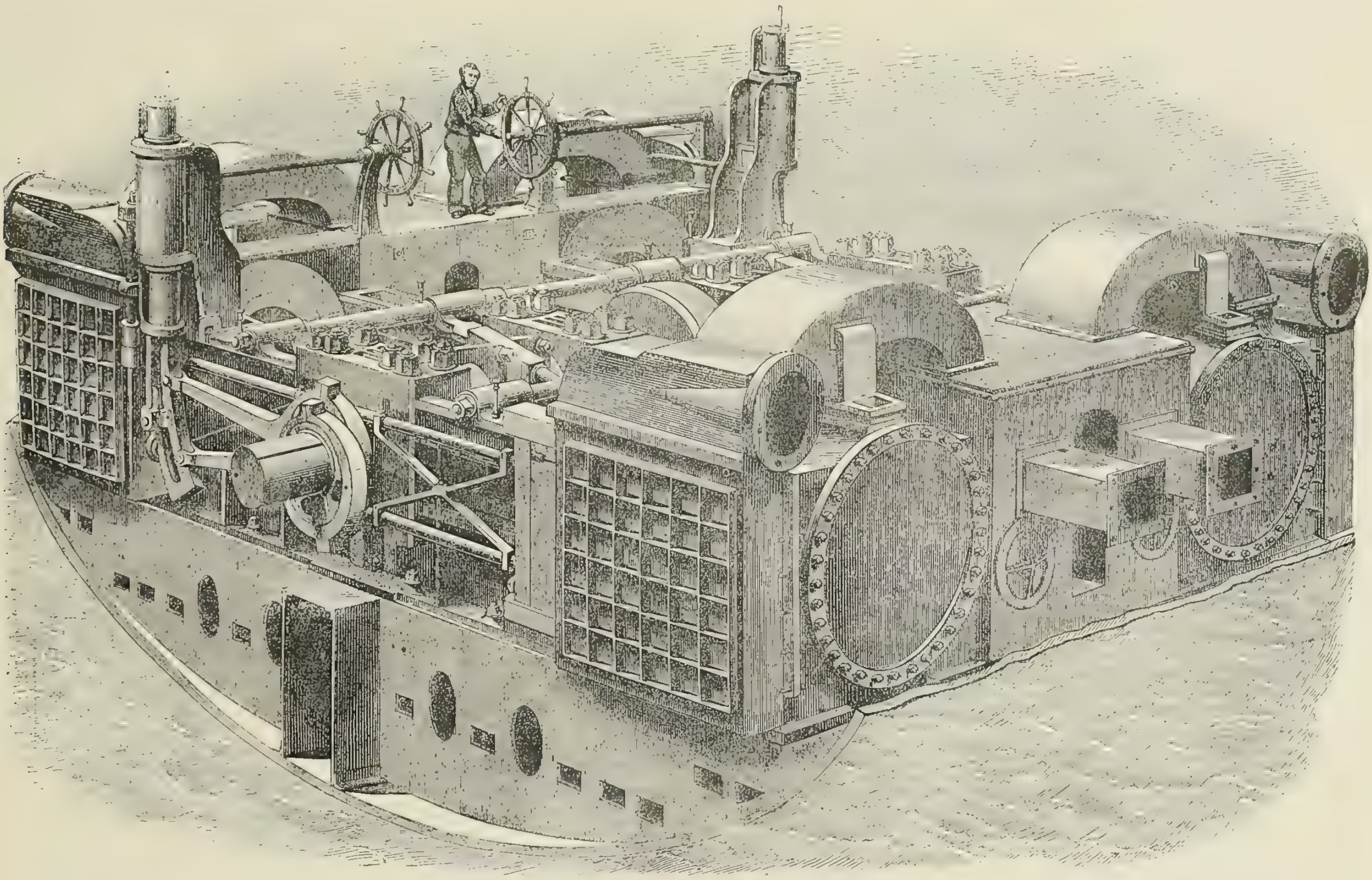
Exporters to Discuss Shipping Bill

At the annual convention of the American Manufacturers' Export Association, which will be held on October 26, special attention will be given to a consideration of the Administration Shipping Bill which is slated to come up for action in Congress next month. During the convention the association will hold a merchant shipping session at which Homer L. Ferguson, president of the Newport News Shipbuilding and Dry Dock Company, will preside. It is understood that the list of speakers at this special session will include W. A. Harriman, head of the United American Lines; Edward C. Plummer, of the United States Shipping Board, and other important speakers.

How a Famous Marine Engine Was Described 65 Years Ago

What "The Illustrated London News" of May 23, 1857, Had to Say About the "Screw Engines" of the Steamship Great Eastern

When the famous steamship *Great Eastern,* designed by John Scott Russell, was under construction in Great Britain 65 years ago great curiosity naturally prevailed regarding the details of her hull and machinery and speculation was rife as to her probable performance when completed. She was to have an overall length of nearly 700 feet, which was more than twice the length of the *Great Britain,* the last large ship built, which in turn was 100 feet longer than any existing warship. Among her other spectacular features, besides size, she was to have a double hull, longitudinally framed and strengthened with two longitudinal bulkheads. Furthermore, she was to have three distinct means of propulsion—sails, paddle wheels and screw.



(Reproduction of Wood Cut from The Illustrated London News, May 23, 1857)

The Screw Engines of the "Great Eastern" Steamship, by James Watt and Company

The screw engines were manufactured by Messrs. James Watt and Company and as described in *The Illustrated London News* of May 23, 1857, were "the largest and most powerful engines ever yet constructed." This article is reproduced below not only because of the data which it contains regarding this early example of marine steam machinery but also because of the author's comments on the probable performance of the vessel. These predictions turned out to be at wide variance with the results actually achieved as she never made over 15 knots with both screw and paddle wheels. The article is also of interest because of the manner

in which it is written which is typical of the style of technical writing at that time. The article is as follows:

"There are four cylinders, each of eighty-four inches diameter, for driving the screw of this vessel. The length of the stroke is four feet, and the makers reckon that the engines will make about forty-five revolutions per minute. The cylinders lie on their sides, as is a common arrangement in screw engines: the piston-rods protrude through the ends of the cylinders nearest the central shaft on the end of which the screw is hung, and the connecting rods attached to the piston-rods engage cranks in the screw shaft and turn it round just in the same manner as the arm turns round a grindstone. The pistons, which are solid plugs, pressed by the steam backwards and forwards in the cylinders, communicate their reciprocating movement through the medium of the piston-rods to the connecting rods; and in this way the screw shaft is turned round, and the vessel is screwed forward in the water just as a screw auger turned round advances in a piece of wood, or a corkscrew in a cork.

"The pressure of the steam in the boilers is 25 pounds on each square inch. The total heating surface in the boilers of the screw engines is about 30,000 square feet. The nominal power of the screw engines is 1,700-horsepower; and, if they work up to four times their nominal power, which is not an unusual performance, the actual indicated power will be 6,800-horsepower. The area of that part of the cross section of the ship which falls beneath the water line is about 2,000 square feet, when the vessel is drawing 28 feet of water. The estimated amount of water evaporated by the boilers of the screw engines per hour is 3,150 cubic feet, and the area of the grate bars is 1,218 square feet.

"The screw is formed with four blades. Its diameter is 24 feet, and its pitch or the distance which it would advance during each revolution if it worked in a solid body, like a corkscrew penetrating a cork, is 44 feet.

"In addition to the screw, the vessel is supplied with paddle-wheels driven by four engines, each of 72 inches diameter of cylinder and 14 feet stroke, and rated collectively at 1,000 nominal horses' power. If we suppose that these engines also work up to four times their nominal power, it will be quite safe to reckon the actual power effective in propelling the vessel at 10,000 indicator horses' power.

"It is a question of much interest to determine what amount of speed this power will impart to the vessel. Messrs. James Watt and Company's anticipation is that the speed of the vessel will be about seventeen miles an hour; and from that to eighteen miles seems to be about the limit engineers have hitherto predicted. But we believe that these anticipations fall very far short of what the real speed will be, and which we do not hesitate to predict will turn out to be between twenty-four and twenty-five miles per hour. No allowance has been made in the existing computations of the speed for the great size of the vessel; yet it is well known that large vessels are more easily propelled, relatively with their proportion of power than small vessels, as is popularly manifested at every yacht race, where an allowance of time is made for the smallness of the vessels; and, in France, where the variation in the resistance consequent upon size has been carefully investigated, it is found that the velocities attained by similar vessels, but of different sizes, vary as the square root of any linear dimension. A vessel, therefore, of twice the length of the *Himalaya*, and with four times the sectional area and four times the power, will be faster than the *Himalaya* in the proportion of the square root of 2 to the square root of 1, or 1.4 times; so that the *Great Eastern*, had she been built of the same size as the *Himalaya*, has proportion of power enough to attain speed of seventeen miles an hour, she will, with her existing dimensions, be 1.4 times faster, or go 23.8, nearly 24, miles an hour. By reckoning the resistance as proportionate to the immersed perimeter, the speed comes out as twenty-three miles. At the increased speed, however, the engines, if duly supplied with steam, will develop more power than at the computed speed, so that, in all probability, a speed of close upon twenty-five statute miles per hour will be attained.

"The existing mode of estimating the resistance by the area of the immersed midship section is erroneous, except in the comparison of vessels of similar dimensions. It is, in putting into motion a column of water by friction that the power of the engine in well-formed vessels is chiefly expended, and the magnitude of this column depends, not upon the area of the cross section, but the amount of rubbing surface it offers to the water. The resistance of rivers is measured by the length of the outline in the cross section of the bed; and large rivers, with the same declivity, run much more swiftly than small. In like manner it should be by the immersed perimeter of the cross section that the resistance of ships should be measured, and when this is done it will be seen how very much less is the proportionate resistance of large vessels. A speed of thirty miles an hour in steam vessels is not, we are persuaded, very distant of attainment. Nor does it appear probable that at high velocities the resistance will be found to increase at the same rapid rate as at low. It is the adhesion of the water which at low speeds consumes power, and this adhesion moves the contiguous water because it is easier to do so than for the vessel to pass over it as if rubbing on a solid. But as with every increase of speed a thicker film of water adheres, the resistance occasioned by moving this mass of water will gradually become so great that it will be easier for the vessel to rub over the film than to drag it with her; and when this takes place the friction will thereafter follow the law which obtains in the case of solid bodies, and the resistance will no longer increase as the square of the velocity. At what point the equilibrium between the adhesion and the friction will be attained is a question which experiment must determine; but the apprehension of the fact that it will be attained at some determinable velocity gives warrant for the expectation of higher rates of speed in steam navigation than has heretofore been thought possible of attainment.

"The success of the *Great Eastern* as a commercial enterprise depends mainly upon her capability of realizing some such speed as twenty-five miles an hour. With such a speed she can command employment on any station, and can also compel the Government to give her a subvention for carrying the mails. With such an ordinary rate of speed as sixteen or seventeen miles an hour her commercial success is far more problematical. Moreover, with so large a cost a vital element is time. She must neither be a day longer on the voyage nor a day longer in harbor than is absolutely indispensable, but must be driven at such a rate as to make the capital productive. Taking the cost at £500,000, and the interest and depreciation at only ten percent upon this amount, we have about £1,000 a week of expense from this source alone. The actual amount chargeable to this item will be very much more than is here reckoned, but the approximation is sufficient to show the importance of attaining and maintaining high speeds on this sole inducement. Of the twenty-five miles an hour we have no doubt whatever, if there is the steam; and the boilers will produce the steam if the draft is sufficient. In most steam-vessels the draft is too sluggish, and the heat in the furnaces is not sufficiently intense. It has been proposed to use anthracite coal in the *Great Eastern*, but this is an experiment, and Welsh coals can be more safely depended on. The bridges at the ends of the furnaces should be high, so as to retain a high temperature in the furnace, which both consumes the coal more effectively and compels more of the heat to enter the water in the region of the furnaces—thus leaving less work for the tubes or flues to do. There should be good steam jets in the chimneys, so as to ensure a strong draft. With these simple precautions we have no fear of the speed; and, as the vessel is the strongest vessel ever sent to sea, there can be no doubt of her complete seaworthiness. The auxiliary engines for turning the screw round when the screw engines are not at work are, in our judgment, unnecessary; and every engine or piece of machinery not absolutely necessary is a complication and disparagement. Simplicity and fewness of parts to look after and keep in repair is a most important desideratum in steam navigation. Transcendentalism will not work in such a sphere, and in our judgment some of the refinements introduced into the *Great Eastern* might have been advantageously omitted. But in all its main features there can be no doubt whatever of the soundness of the design or of the excellence of the execution, while we believe that the performance of the vessel will exceed everything which the most sanguine supporters of the enterprise have ventured to anticipate, and will far outrun the prognostications which engineers, overlooking the element of size, have hitherto formed."

Broken Propeller Blades on 9,500-Ton Vessels Replaced With Aid of 4,500-Ton Floating Dry Dock

During the month of July two of the Matson Navigation Company's single screw steamers, the *Manukai* and *Manulani*, each of 9,500-tons gross register, arrived in Honolulu in crippled condition, due in both cases to the same mishap—the loss of one blade of its propeller. The nature of the accident, which was identical in both cases, is shown in Fig. 3.

The contract for replacing the broken propeller blade on each of these steamers was awarded to the Honolulu Iron Works and the work was carried out on the 4,500-ton floating dry dock of the Inter-Island Steam Navigation Company of Honolulu. This dry dock, which has wooden pontoons and steel wings, was built in 1913 from designs by William T. Donnelly, consulting engineer, New York. Al-

Fig. 1.—Lifting Stern of 480-Foot Steamship Manulani in 300-Foot Floating Dry Dock at Honolulu for Propeller Repairs

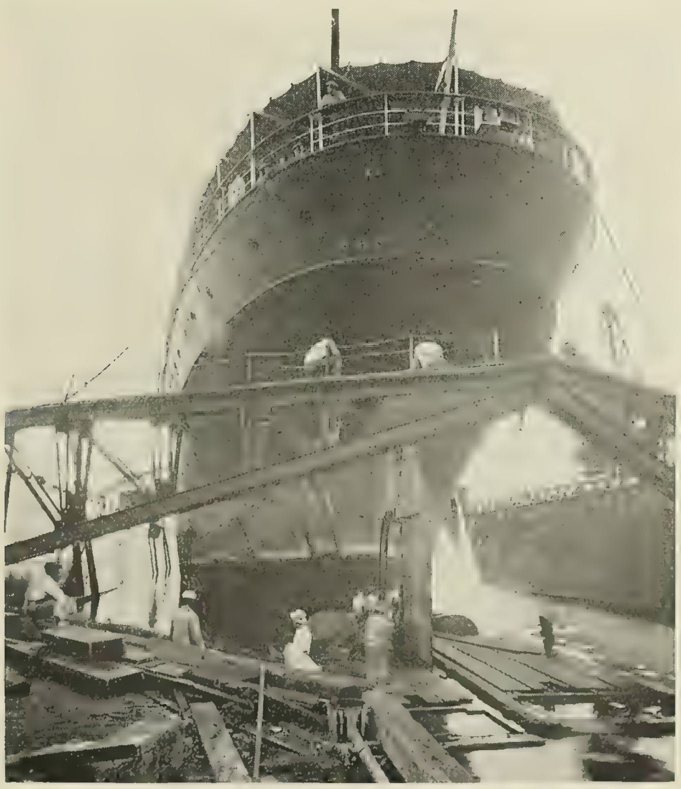


Fig. 2.—Replacing Broken Propeller Blade of S.S. Manukai on 4,500-Ton Floating Dry Dock at Honolulu

Fig. 3.—Broken Propeller Blade on the Manukai. Identically the Same Mishap Occurred on the Manulani

though the dock has a lifting capacity of only 4,500 tons and its length over the wings is only 300 feet, nevertheless it was found possible, as shown by the illustrations, to lift the vessels, which in each case are over 9,500 tons gross register, and have a length of 480 feet, sufficiently to expose the propeller so that the broken blade could be replaced.

In the case of the *Manukai,* which had on board at the time of docking 3,200 tons of cargo, making a docking tonnage of 12,747, the propeller blade was replaced in two hours and 15 minutes. The work on the *Manulani,* which had on board 4,400 tons of cargo, giving a docking tonnage of 13,956, was finished in two hours flat.

Federal Shipyard Building Nine 80-Ton Scotch Boilers

Largest Marine Boilers Constructed in New York District to Operate at 225 Pounds Working Pressure

MANY special features of construction, due to their size, and the weight of materials used, have been incorporated in the nine single ended Scotch marine boilers which are now under construction for the Luckenbach Steamship Company at the Federal Shipbuilding Company's plant, Kearny, N. J. These boilers, which have a diameter of 17 feet 6 inches and a length of 13 feet, are intended for installation in ships of the Luckenbach fleet, which are being reconditioned at the Baltimore plant of the Bethlehem Shipbuilding Corporation. The boilers will be used to replace watertube boilers which were removed from the vessel.

Construction of the very highest quality has been maintained to meet the requirements of the United States Steamboat Inspection Service, the American Bureau of Shipping and Lloyd's Register of Shipping. The boilers are designed to burn oil under the heated forced draft system. The fact that the dry weight of each boiler will be approximately 80 tons gives an excellent idea of their unusual size. The weight of the shell alone with butt straps is about 67,000 pounds, while 3½ tons of rivets are used in each boiler. In the case of the butt straps, the rivets used are 8⅝ inches long and weigh 8¼ pounds each. The largest shell plate is 243⅛ inches by 144¼ inches by 2 inches and weighs 10 tons while the bottom heads are cut from plates 232⅛ inches by 164¼ inches by 1-3/32 inches and weigh 6 tons. The shell is made in one course and three plates are used in the circumference. The longitudinal seams are of double butt strap construction with both the inside and outside straps of equal width. The outside strap is 2 inches thick, as in the case of the shell plate, while the inside strap is 1¾ inches thick. Rivets 1⅞ inches in diameter are driven through holes drilled to 1-15/16 inches diameter. The efficiency of the plate used in the straps is 82.5 percent; the rivet efficiency 107.8 percent; and the combined plate and rivet efficiency 86.3 percent.

General Characteristics

In order to increase the life and efficiency of the boilers in service, the scantlings have been kept well in excess of the requirements of the classification societies. Special attention in this connection is called to the thickness of the outer butt strap, mentioned above, which was made 2 inches thick to conform with the specifications and is 23 percent

Fig. 1.—Side Bay of Federal Boiler Shop with Combustion Chambers Under Fabrication

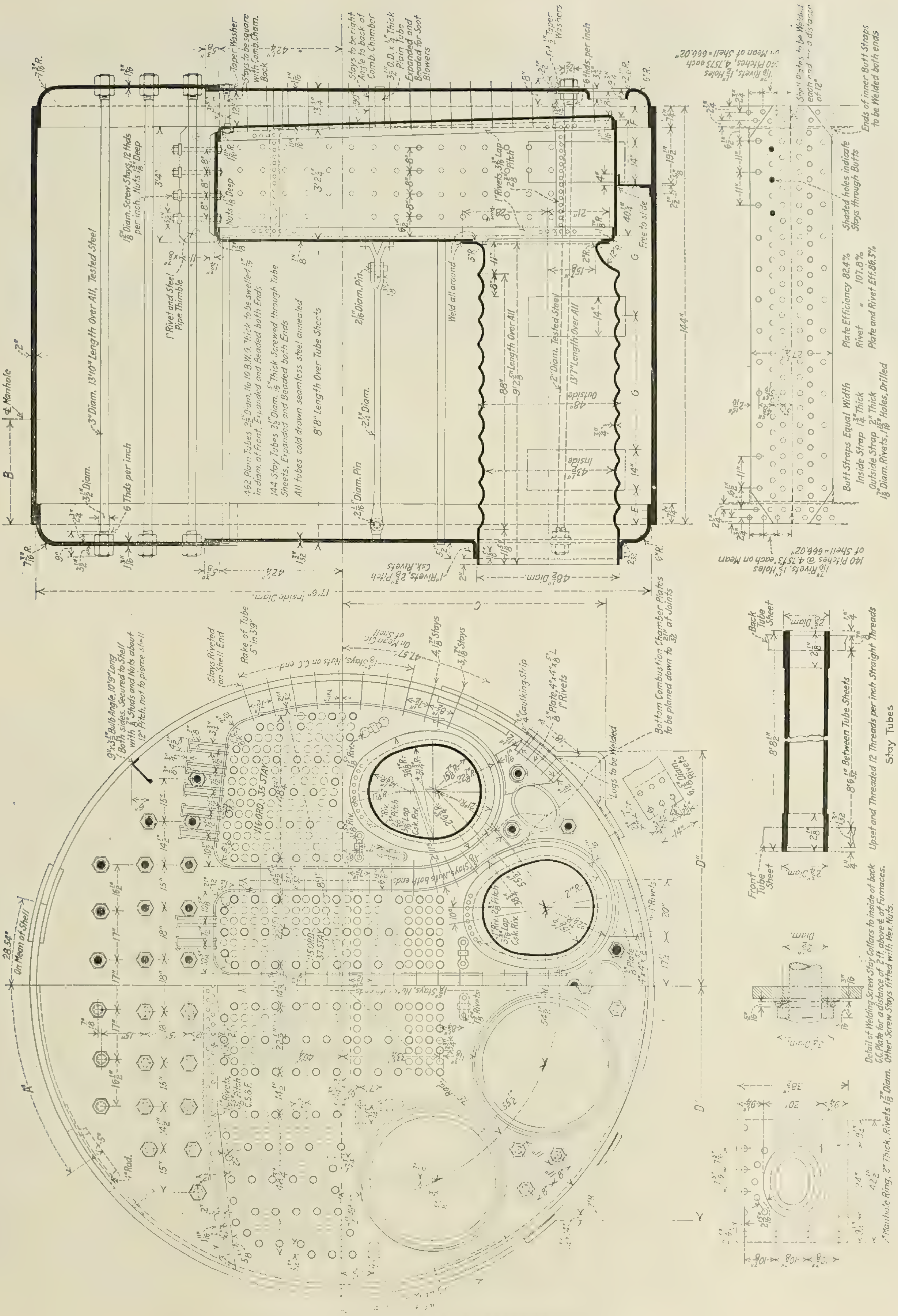


Fig. 2.—Structural Arrangement of New Marine Boilers with Details of Longitudinal Seams, Manholes, Tubes and the Like

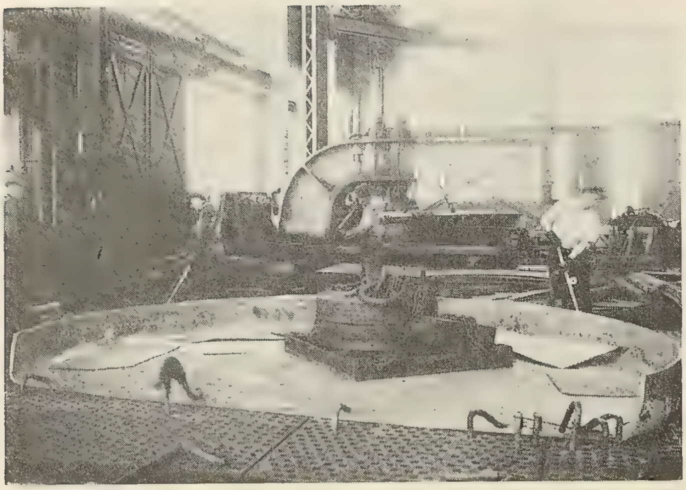


Fig. 3.—Furnacing and Annealing Boiler Head

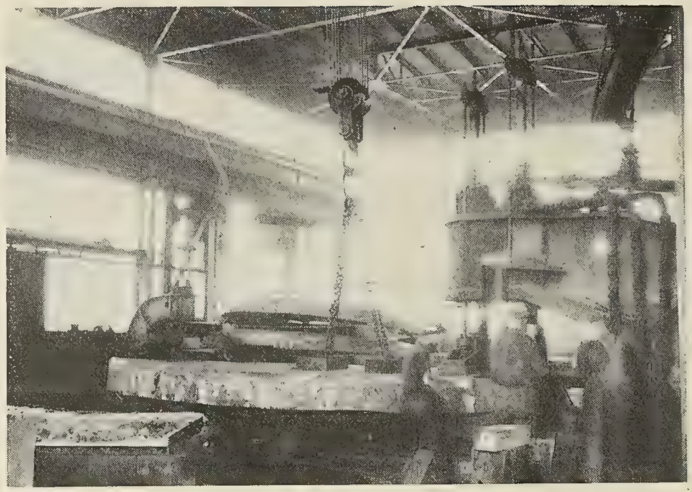


Fig. 5.—Flanging Lower Head

in excess of the requirements. Because of the extreme proportions thus provided, ample space has been available for a wide spacing of tubes and an unusually wide space between the lower banks of tubes and the furnaces. This feature, because of the possibility of adequate maintenance and cleaning facilities, will insure a high operating efficiency of the boilers at all times. The steam space ratio of 0.29, especially for a boiler of this size, gives a very large steam space and will tend to insure against priming. As a further preventative against priming in case of the ship rolling, two swash plates are provided by the installation of a 9-inch by 3½-inch bulb angle on each side of the shell above the waterline.

Each combustion chamber is supported from below by a stool or saddle riveted to the shell plate. These saddles are built up of 2½-inch by 2½-inch angles and steel webs of ⅝-inch plate so installed as not to interfere with access from the manholes and so that the combustion chamber is free to move.

All flange plates have large radii, those of the main heads being about 5 inches inside of the plate. Care in all cases has been taken that the shell plates and butt straps are circular in form and that the top of the back connections are well rounded at the corners.

There are three 12-inch by 16-inch manholes located in the lower back head between the furnaces and one near the

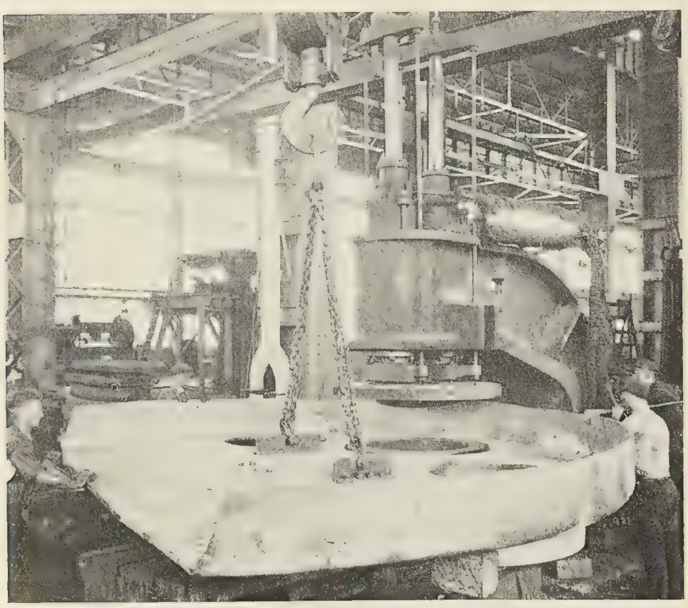


Fig. 4.—Flanging Furnace Holes in Front Head

top of the back head in the shell. The top heads are well braced with twenty-four 3-inch steel stays and the wide spaces in the lower heads and combustion chamber tube sheets are supported with eight 2½-inch crowfoot stays.

All tubes are of cold drawn seamless steel annealed and are 2½ inches outside diameter. The ordinary tubes, of which there are four hundred and sixty-two, are of No. 10 B. W. G. material, while the one hundred and forty-four stay tubes installed are 5/16-inch thick. The ordinary tubes are swelled 1/16 inch in diameter on the front end and the stay tubes upset and threaded on both ends. The tubes have a length of 8 feet 8 inches over tube sheets and are expanded and beaded over on both ends.

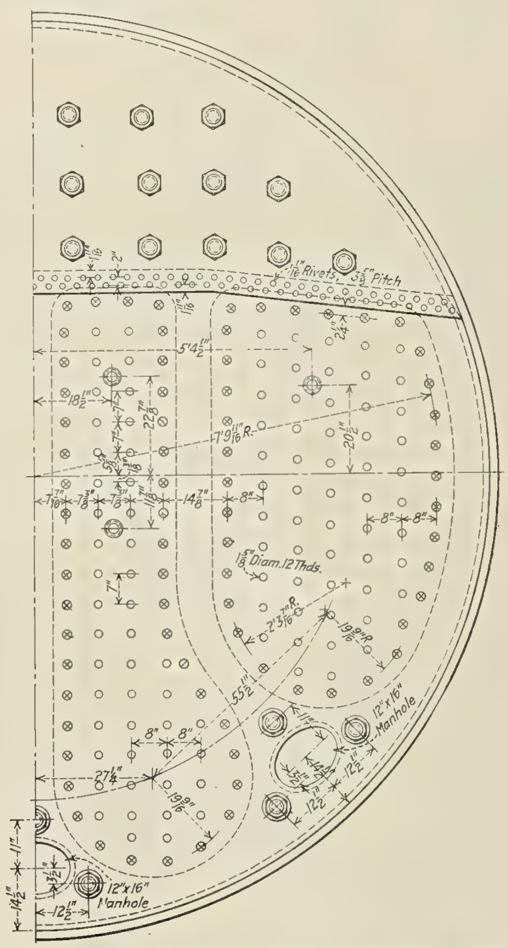


Fig. 6.—Details of Back Head of 80-ton Boiler

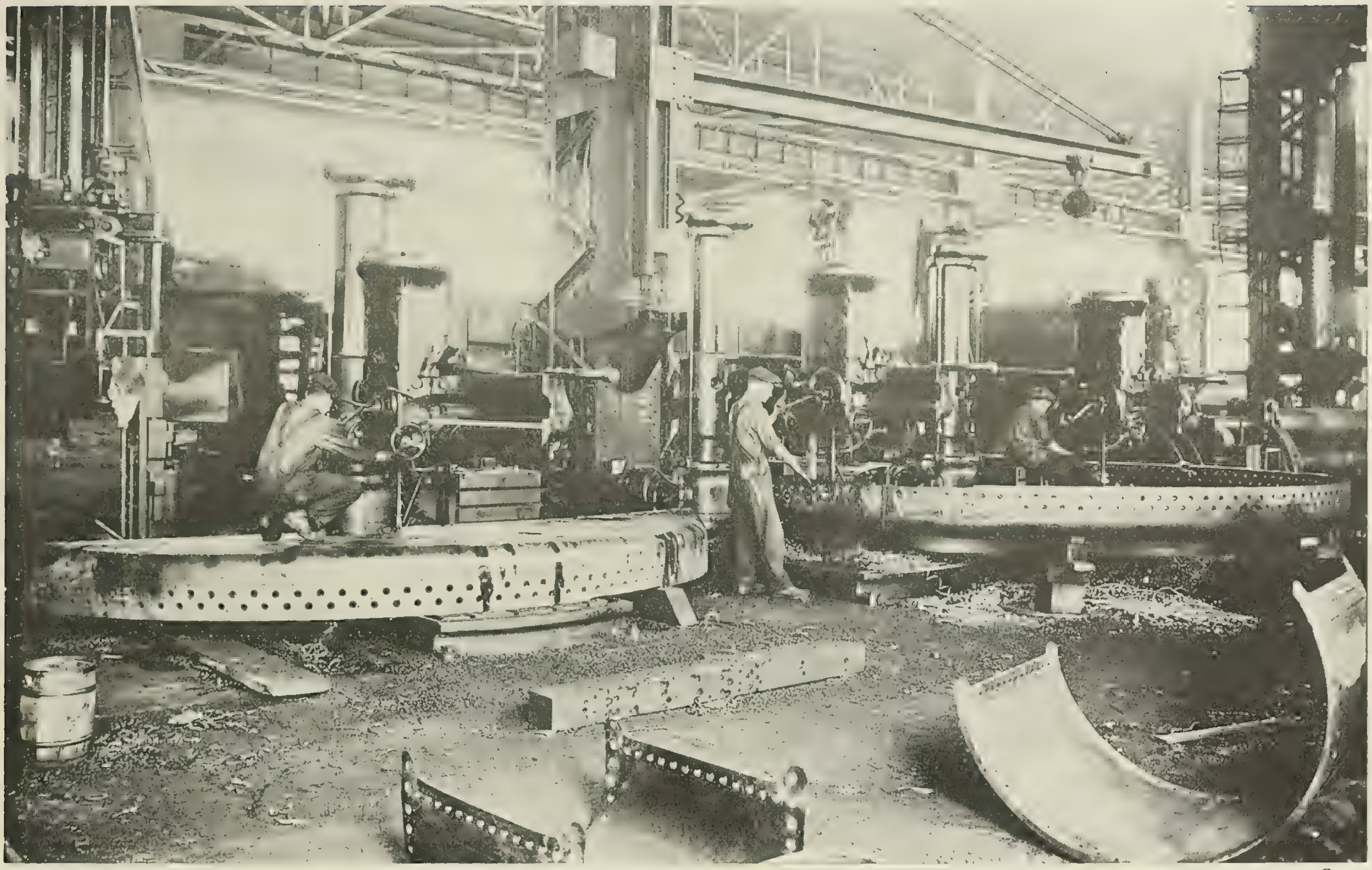


Fig. 7.—Cutting Tube Holes and Stayholes in Boiler Heads

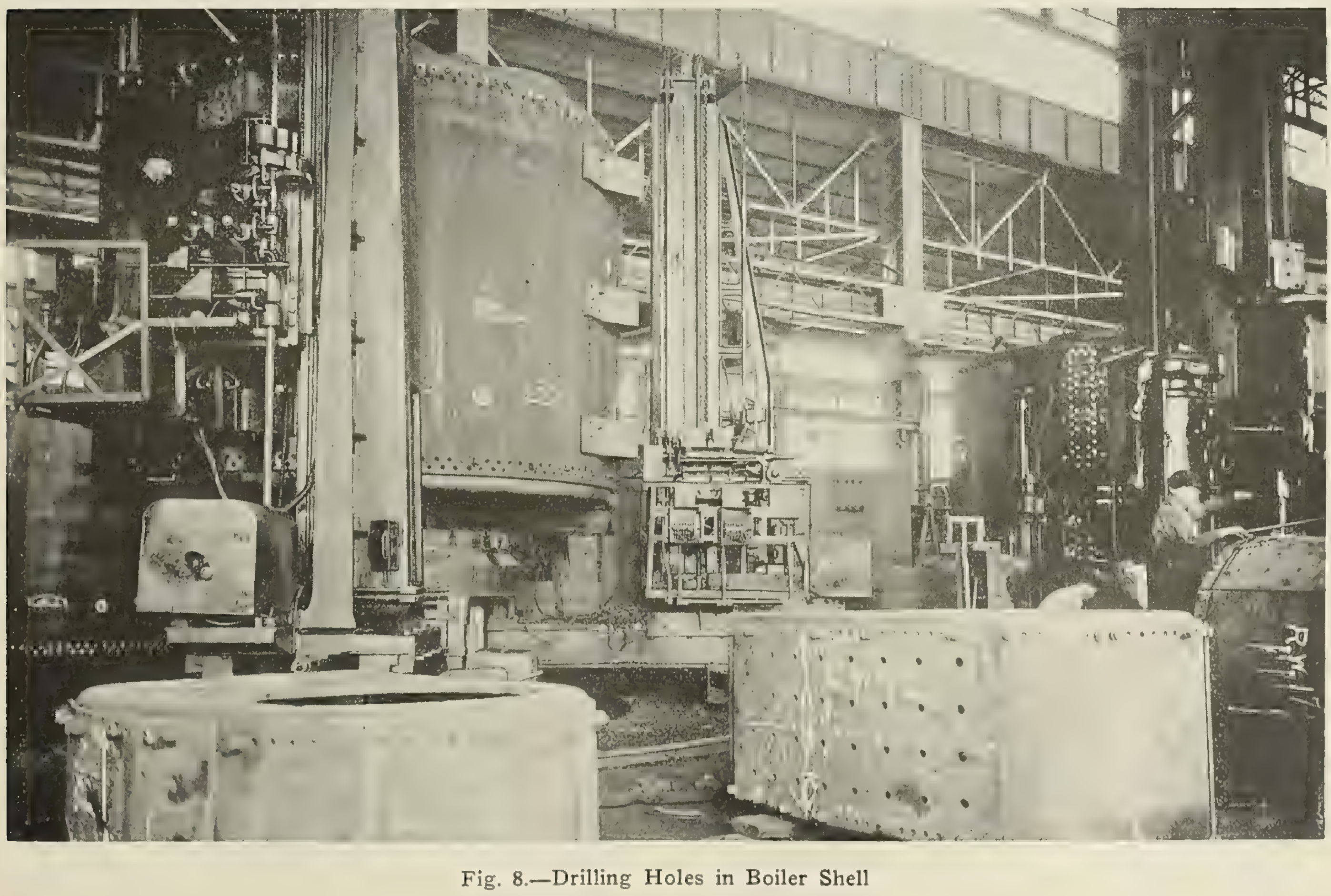


Fig. 8.—Drilling Holes in Boiler Shell

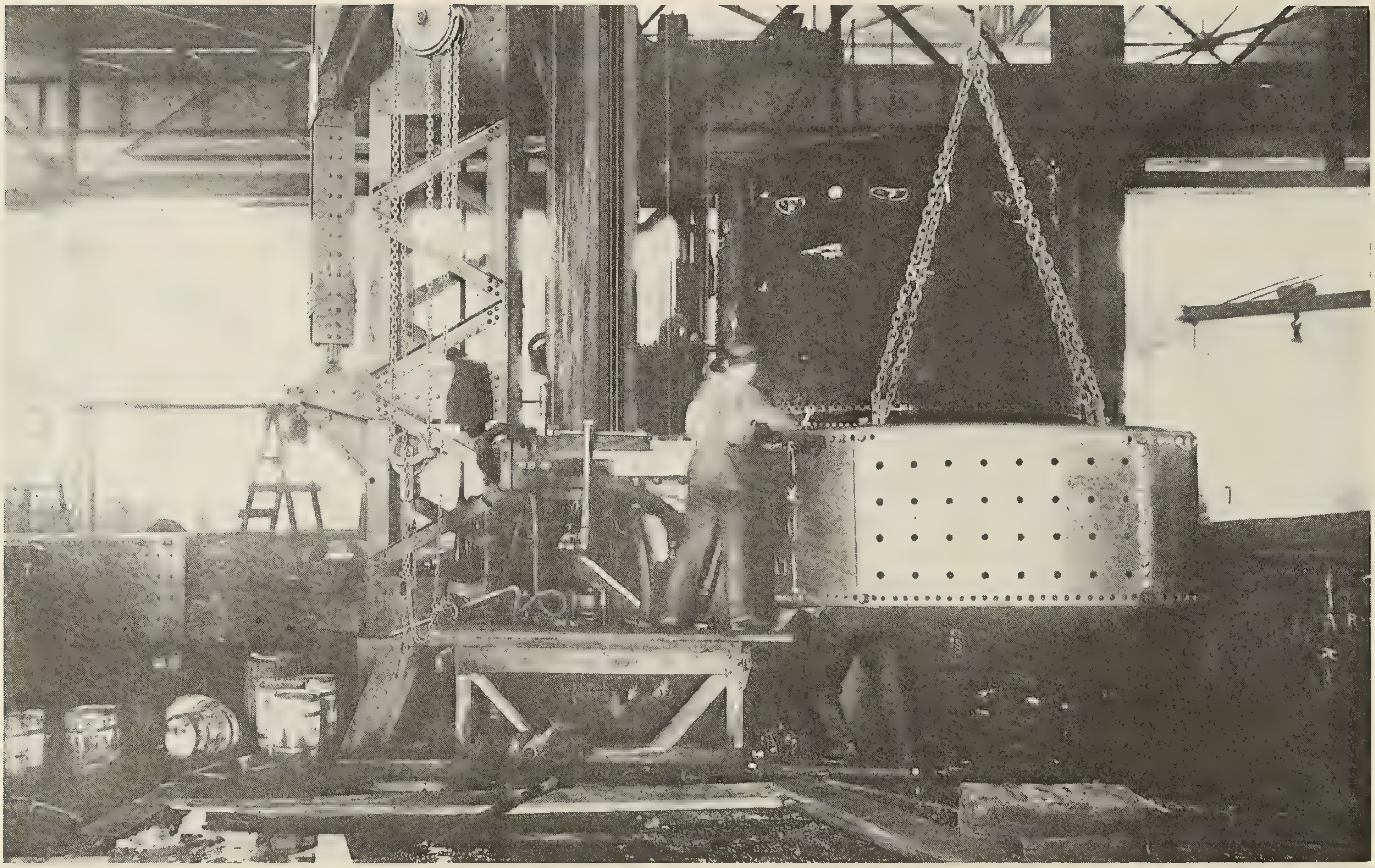


Fig. 9.—Riveting Combustion Chambers

Combustion Chambers

There are four separate combustion chambers in each boiler, each chamber being made up of 7/8-inch thick tube sheet and 11/16-inch thick back sheet and four wrapper plates. The top and side wrapper plates are 21/32-inch thick and the bottom plate 1 1/16-inches thick. All seams are single lap riveted with 1-inch countersunk rivets.

The backs of the combustion chambers have a 4-inch slope while the tops of the wing combustion chambers slope down toward the shell 5 inches from the center. All screw stays connecting the back sheets with the back head of the boiler are set in normal to the combustion chamber sheet. The screw stays are finished smooth between the plates to a diameter equal to the root of the threads.

Four furnaces of the Morison corrugated suspension type are fitted in each boiler and these have an inside diameter of 43½ inches. These furnaces have horse-collar connections to the combustion chamber with enlarged front ends to permit withdrawal.

Each boiler has six supporting saddles, three on each side, made of 1¾-inch plate 14 inches long. These saddles are secured to the shell with twelve 1⅝-inch rivets and a calking strip ¼-inch thick inserted between the shell and the saddles.

A perforated dry pipe 7 inches in diameter is fitted the full length of the shell with a cap on the end and securely fastened to the shell.

Large Amount of Welding Used

In order to insure a tight boiler at all times, under adverse operating conditions and the difficulty of maintaining boilers at sea, an unusual amount of electric arc welding has been done on all the boilers. The seams and stay nuts in the combustion chambers are welded up to a point 2 feet above the centerline of the furnace. The inside butt straps are beveled down on the ends to the thickness of the boiler head flanges and welded across the ends at that point and for a distance of 6 inches along the head flange and the same distance along the butt straps from the flange. Where the shell plates butt together they are beveled and welded for a distance of 12 inches from each end. The saddle lugs, which are fitted with a ¼-inch calking strip, as indicated before, are welded on the inside of the lugs to the shell.

All seams of the combustion chambers in contact with flame are welded inside and out to protect the edges of the plates and insure against any possible leaks. This welding is carried to a point 2 feet above the centerline of the furnaces. All screw stays up to a point 2 feet above the centerline of the furnaces are fitted with special round collar nuts which are welded after being screwed on the stays.

All welding is built up of several layers to the required amount, each layer being thoroughly wire brushed and hammered before the succeeding layer of welding material is added. The finished weld in all cases is then peaned with pneumatic hammers.

Fittings and Mountings

Six Diamond rear end soot blowers are fitted to each boiler; one in each wing combustion chamber and two in each inboard combustion chamber to enable all tubes being thoroughly swept by as near a direct jet of steam as possible.

All connections to the boiler heads and shell are fitted to nozzles of open hearth steel forgings which are riveted to the boiler. These nozzles are made of sufficient length to allow removal of valves without disturbing the lagging to get at the nuts and bolts. The main and auxiliary feed nozzles have necks extending through the head of the boiler and are fitted with a flange securely screwed on from the inside of the boiler. The zincs are supported by hooks on straps suspended down between the nests of tubes from the main stays. Thirty-six zinc slabs 12 inches by 6 inches by ½ inch are fitted.

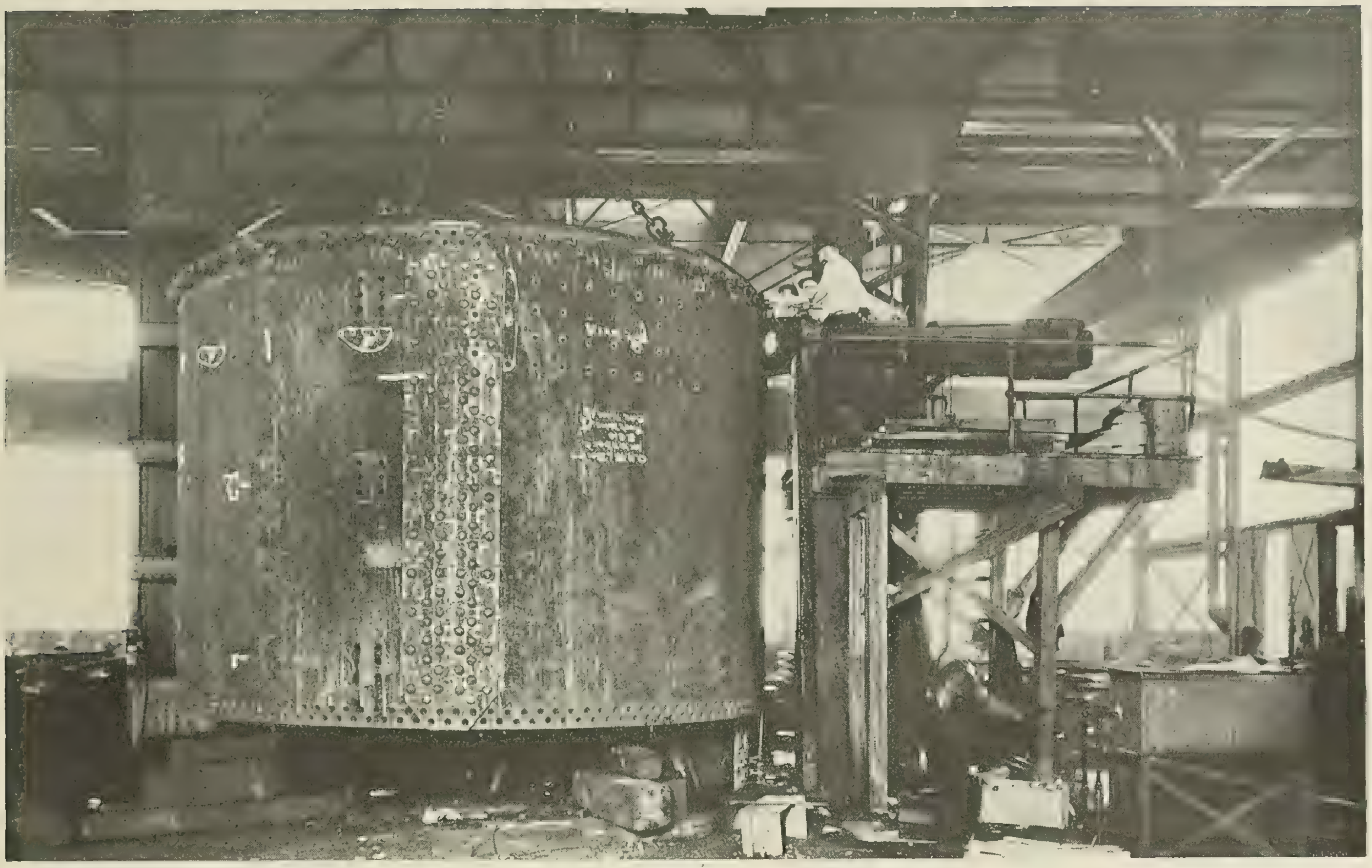


Fig. 10.—Fitting Up Head in Marine Boiler Shell

General Details of Boilers

Diameter of boilers (inside)	17 feet 6 inches
Length (over bottom heads)	13 feet 0 inches
Thickness of shell	2 inches
Number of furnaces	4
Inside diameter of furnaces	43½ inches
Number of plain tubes	462
Number of stay tubes	144
Outside diameter of tubes	2½ inches
Distance between tube sheets	8 feet 6 1/32 inches
Heating surface of tubes	3,370 square feet
Heating surface of furnaces	425 square feet
Heating surface of combustion chambers	465 square feet
Total heating surface	4,260 square feet
Net area through tubes	15.4
Steam pressure	225 pounds
Steam space	0.29
Equivalent grate area with 5-foot 6-inch grate	79.75
Heating surface ÷ grate area	53.4
Weight of boiler, dry	80 tons

The main steam connection is seven inches in diameter and is fitted with a wrought iron slotted dry pipe. A 1¼-inch Weir hydrokineter is fitted on the shell between inboard and wing furnaces for circulating water when starting to get up steam. A scum pan and salinometer cock are fitted to head of boiler. There are two water columns and three try cocks fitted to the head of the boiler.

Methods of Manufacture

All work of manufacture from the flat plates to testing has been done in the boiler shop of the Federal Shipbuilding Company which is one of the best equipped marine boiler shops in the country. On account of the great size and weight of the boilers special and extra equipment was made up for handling the work through the shop.

The butt straps were formed to shape under a 200-ton hydraulic press. The 1⅞-inch rivets in the butt straps were driven by a 200-ton hydraulic riveter. Rivets in the circumferential seam of the back head were driven by a 150-ton hydraulic bull, while the rivets in the straight seams of the heads and the combustion chamber seams were driven by a 75-ton bull. In the circumferential seam of the front head the rivets were hand driven with pneumatic riveting hammers. Special riveters of 80 tons pressure were used for the seam at the furnace mouth which is riveted the complete circumference of the furnace.

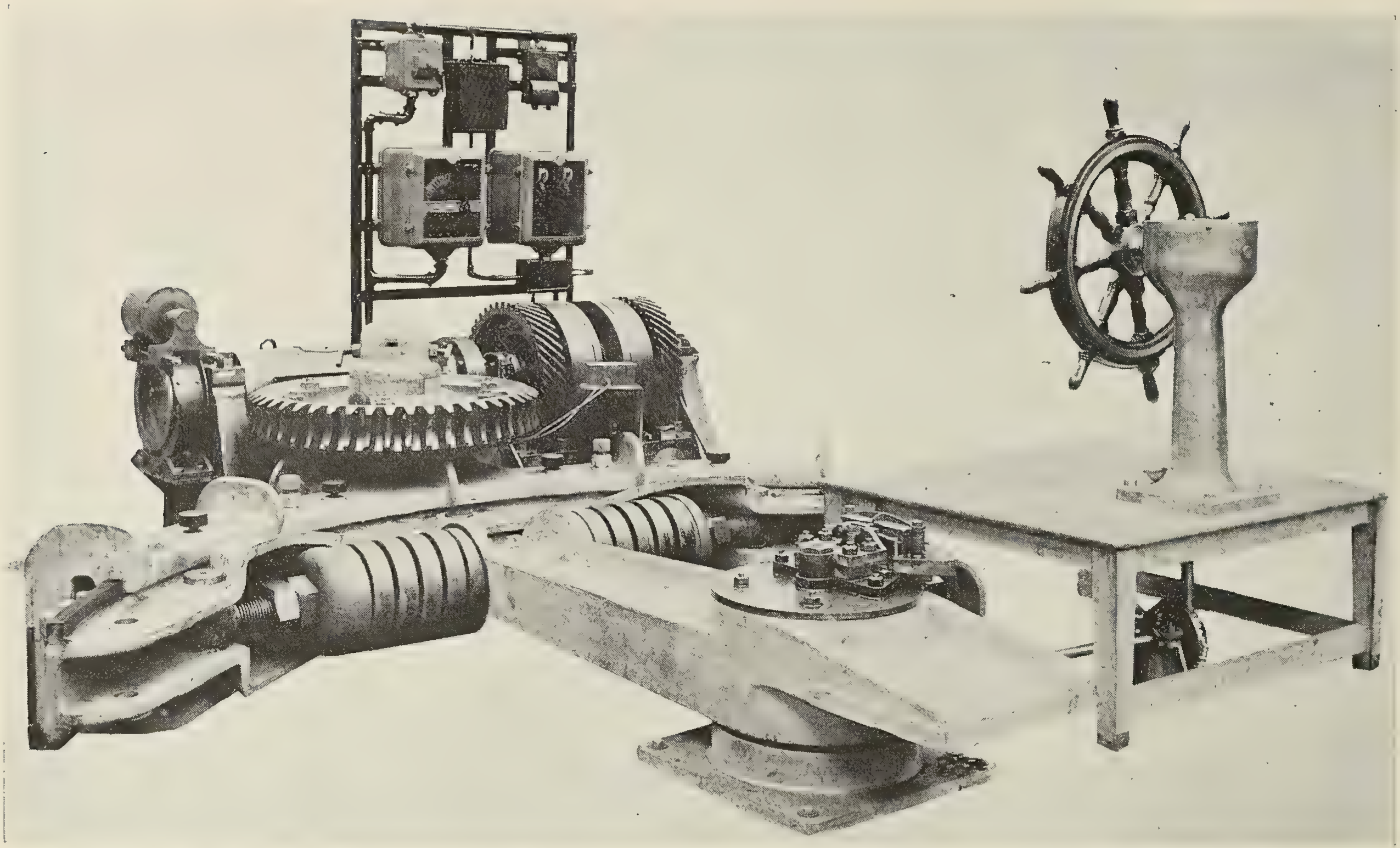
Because of the extreme thickness of shell plates, it was necessary to start the curvature by hydraulic press for a short distance, so that the plates could be entered in the rolls. The outer edge of the longitudinal joint had to be finished by hydraulic press to fair up properly when assembled. The curvature of the butt straps was also imparted by hydraulic press.

All plates were taken apart after fitting up and the surfaces cleaned and burrs removed with emery wheels before reassembling to insure clean metal to metal joints. In reassembling the work for riveting, dowel pins were used to insure perfect alinement of holes.

These boilers in general represent the last word in Scotch marine boiler design and construction and their service records will serve to uphold the reputation for reliability under adverse conditions that this type boiler has gained in its years of powering the merchant ships of the world.

Simplified Type Direct Rudder Head Steering Gear

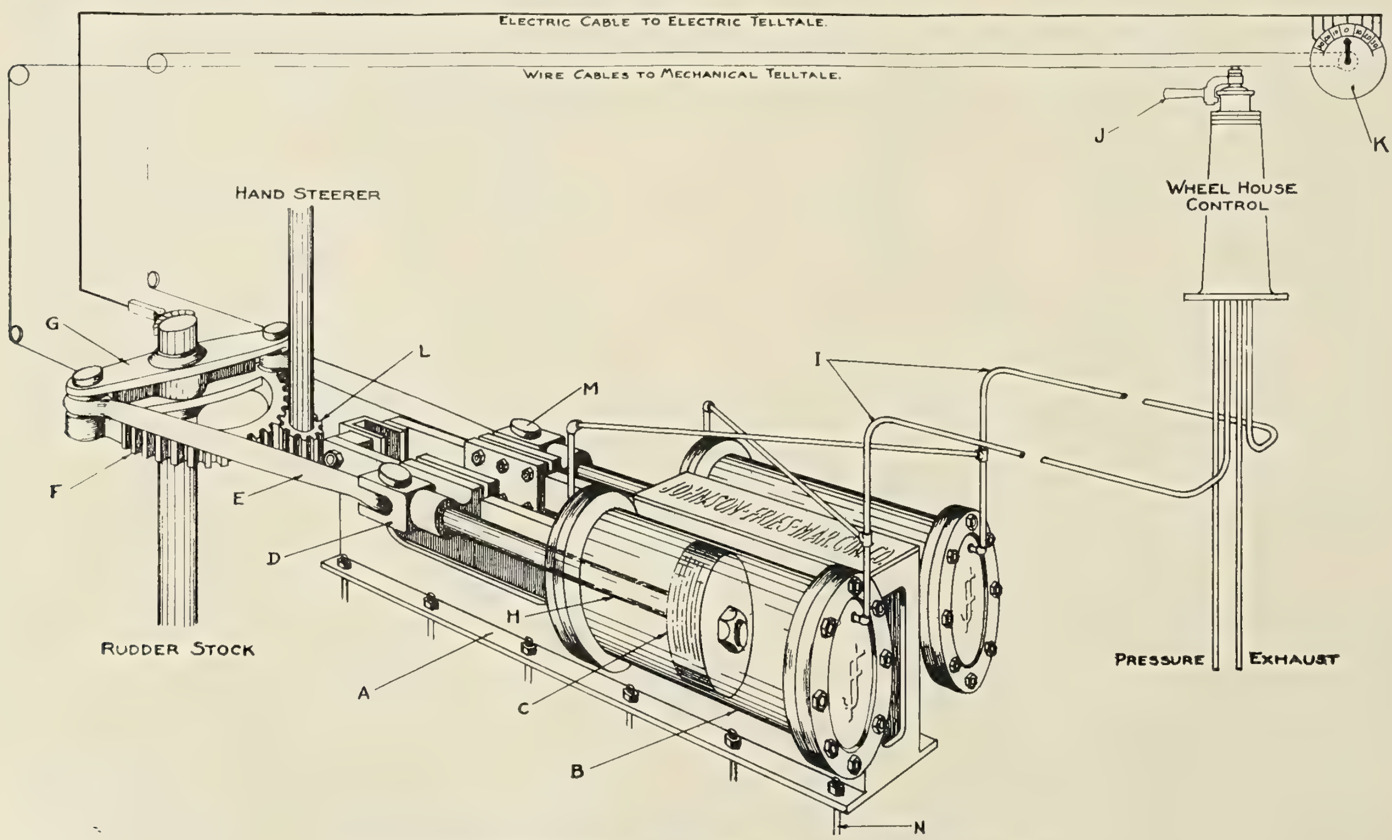
Working from the original barrel steering gear driven by a steam engine, through various stages of steam driven screw gears, the Bow, McLachlan & Company, Ltd., London, England, has developed an electrically operated direct rudder head gear which can be controlled by any of the customary methods at the various parts



Electrically Operated Direct Rudder Head Gear Attached to "Guided Segment" Type Steering Installation

of a vessel from which it is desirable to operate the ship. The motor actuating the gears runs continuously and drives two electro-magnetic clutches which run loose on the driving shaft. These clutches run in opposite directions, thus controlling the forward and reversing action of the shaft. The shaft may be arranged to operate a number of different steering installations.

In the accompanying illustration, the shaft is attached to the "guided segment" gear. In this case, a worm is connected to the end of the shaft which meshes with a horizon-



Diagrammatic Sketch of Johnson-Fries Pneumatic Steering Gear

tally mounted worm wheel carried on a spindle to which a toothed pinion is fixed. The latter meshes with a toothed segment connected through spiral springs to the tiller. Movement of the worm wheel shaft in one direction or the other turns the rudder to port or starboard as required.

Mounted on the rudder head is a new type of hunting switch which is actuated by the steering wheel. Motion of the wheel in one direction or the other completes the electric circuit to one or the other of the clutches and moves the rudder through the gearing described. When the rudder has moved to the angle corresponding to the angle of rotation of the steering wheel the hunting switch breaks the circuit to the acting clutch which releases the worm wheel shaft and stops further motion until the steering wheel is moved again.

To prevent overloading of the motor the clutches are arranged to slip at any pre-determined load without damage to themselves or resulting discrepancy between the rudder angle and position of the steering wheel corresponding to that angle.

Resistance of Ships to Propulsion

Methods of Estimating Power from Model Tests —Corrections in Passing from Model to Ship

By A. J. C. Robertson*

THE necessity for accurately calculating the power to propel a ship is so apparent that many attempts have been made to enunciate formulæ which will provide the information desired. We are all familiar with the well-known Admiralty formulæ,

$$\text{I. H. P.} = \frac{\Delta^{2/3}\, V^3}{\text{Constant}_1} \text{ or I. H. P.} = \frac{V^3\, M}{\text{Constant}_2}$$

where $\triangle$ is displacement in tons, V speed in knots and M area of midsection in square feet. We are probably also aware that the so-called constants vary enormously with size proportions and speed of the ship and, if the constant has to be guessed, we may as well guess the power at once.

A modification of the first formula recommended by A. E. Stevens,

$$\text{I. H. P.} = \frac{\Delta\, V^3}{\text{Constant}\sqrt{L}}$$

claims to give better results than the Admiralty formulæ but this constant varies through a wide range also with size of ship, draft ratio and speed ratio.

A very clever analysis of resistance was made by Professor Hovgaard in 1908 (Transactions of the Institution of Naval Architects) in which many provisional formulæ were worked out and curves plotted upon actual resistance curves, thus showing the measure of accuracy attained, but, though the resulting formula included wetted surface, coefficient of fineness, length, breadth, depth and speed, the "constants" were still found to vary considerably and in accordance with unknown laws.

This, however, is not surprising, for in the nature of things no formula of constant form can possibly take care of the infinite variations which can be made in the dimensions, proportions and form of a ship's hull. Even if all the dimensions are absolutely fixed, no two naval architects could possibly produce an identical set of lines.

Two such independent designs might and probably would have identical resistances at one speed, but the architects themselves could not say at what speed that would occur and the similarity would certainly not extend through any great range of speeds.

The major resistances which absorb the power used in the propulsion of a ship are here tabulated:

(a) Frictional resistance
(b) Wave making
(c) Eddy making
(d) Windage and rudder
(e) Restricted channel
(f) Wake deduction
(g) Propeller efficiency losses
(h) Shaft friction

*Naval architect, Munson Steamship Line, New York.

And if power is measured inside the engine by indicator cards or similar methods, the initial friction losses of the engine must be added to this list.

Froude, many years ago, was able to enunciate the laws of comparison which have made it possible to estimate the effect of size on the resistance of a vessel. This law, also called the law of mechanical similitude as applied to ships, requires that for ships that are exactly similar except in size, as expressed in terms of a single dimension, L:

(a) corresponding speeds are speed proportional to $\sqrt{L}$.
(b) corresponding displacements are proportional to L^3.
(c) corresponding resistances are proportional to L^3.
(d) corresponding powers are proportional to $L^{3.5}$.

This law at once made it possible to look for a solution of the problem of propulsion by the testing of small models under conditions which could be maintained the same at all times, or at least where the changes were so small and so carefully measured that proper corrections could be made.

A large experimental tank was constructed for this purpose at Torquay in England many years ago, and at this tank the foundations of the science of ship resistance were well laid by Mr. Froude.

Application of Model Experiments

It was early demonstrated that the friction of the water on the skin of a ship did not strictly follow the law of mechanical similitude owing to the layer in contact with the ship acquiring a velocity in the same direction as the ship, thus making a difference between the apparent and the real speed of the ship through the water, and this change in velocity was found to be a direct function of the length of the vessel. This skin resistance could be expressed thus:

$$R_f = SfV^n$$

where S is the wetted surface and V the speed, f and n being constants for a fixed length, and could be tabulated for various lengths of ship. With this allowance for frictional resistance taken into account it has been found possible to calculate from model experiments items (a), (b) and (c).

The resistance and speed of the accurately cut model ship are electrically recorded for a large number of speeds, a run of the model being made at each speed. From this total resistance (usually measured in pounds) the calculated resistance due to the surface friction is subtracted, the remainder, usually designated as the residuary resistance, is multiplied by suitable factors for the required size of ship and to the result the calculated frictional resistance of the ship is added, giving the total resistance, usually expressed in effective horsepower.

That is the method in use at both the Washington and Ann Arbor model tanks in this country, but another method

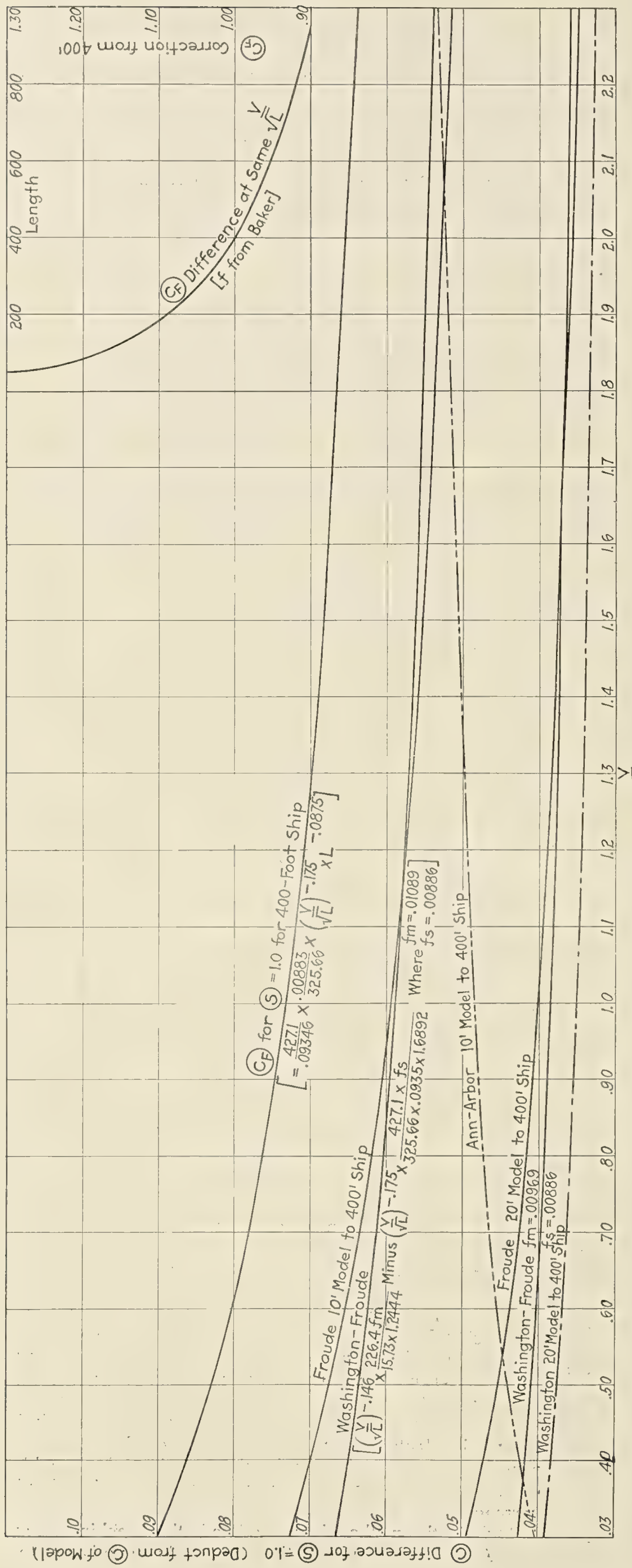


Diagram Showing (1) the Value of (C_f) at (S) = 1.0 for a 400-Foot Ship and (2) the Deduction from (C_f) of Ship with (S) = 1.0 as Calculated by Using the Coefficients of Various Authorities for 10-Foot and 20-Foot Models and 400-Foot Ship

is possible. This is to calculate the horsepower of the ship directly from the resistance of the model and then deduct a certain amount due to the lesser resistance per square foot of surface for the large vessel as compared with the model. Either method will of course give accurate results, but the latter method has some advantages, in that it proceeds by differences, thereby preventing large errors and it can be carried out in such a way as to give a unit of resistance equally applicable to any size of ship with a unit correction value for variations in size.

This method, originated also by Froude, designates the unit of resistance

$$(C) = \frac{\text{E. H. P.} \times 427.1}{V^3 \Delta^{2/3}}$$

and the (C) correction in passing from the model to a standard size of ship (for convenience 400 feet is probably the simplest) is in the form of a small deduction from the (C) value of the model.

For vessels other than 400 feet long the (C) correction is very small and is a deduction for larger ships and an addition for smaller ones.

This method of expressing the ship resistance by (C) value is now practically universal in Europe, and when once adopted is sure to displace other methods.

The reasons for this are that (C) is very sensible to variations of resistance, it fluctuates less than most constants and is easily utilized for speed estimates. Moreover (C) values are now available for a very large number of ship models, tested through a wide range of speeds.

Calculations for the (C) Values

A more detailed examination of Froude's "constant" system of notation and the calculations for the (C) values will therefore be interesting, especially as the calculations involved in obtaining (C) from model experiments have been omitted from the usual text books.

Δ = Displacement in tons, salt water at 35 cubic feet per ton.
δ = Displacement in pounds, fresh water at density 1.0 : 1.026 salt water.
V = Speed in knots of 101.33 feet per minute.
R = Resistance in pounds.
L = Length on waterline in feet.
W = Wetted surface in square feet.
U = Length of side of cube having contents equal to displacement in cubic feet.

Then $U = \Delta^{1/3}$

$$K = \text{Speed of wave of length } \frac{U}{2} = \frac{V}{\Delta^{1/6}}\sqrt{\frac{4\pi}{g}}$$

with speed V in feet, seconds and g., the accelerating force of gravity, in feet per second.

Also $$\frac{C}{1{,}000} = \frac{R}{\Delta K^2}$$

and assuming that the specific gravity of sea water is 1.026—64 pounds per cubic

EXTENSION OF MODEL TESTS TO SHIP

Design No. 2033

Test No. Ann Arbor 2033-B. Dated Aug., 1920. Name ....

ITEM	MODEL		SHIP	
Displ. Length........	10.0	Ft.	534.0	Ft.
Breadth	1.3125	Ft.	70.0	Ft.
Draft	.5875	Ft.	31.37	Ft.
Wetted Surf.	18.82	Sq. Ft.	53,678	Sq. Ft.
Displ................	308.3	Lbs.	21,495	Tons
$Displ.^{2/3}$	45.63		773.	

$$(S) = \frac{\text{Wetted Surf.}}{\text{Displ.}^{2/3}} \times \begin{cases} 15.73 \text{ for Model} = 6.49 \\ .09346 \text{ for Ship} = \end{cases}$$

$$S\Delta \text{ for Ship} \frac{\text{Displ.}}{(\text{Displ. Length} \div 100)^3} = 141.61$$

$$(M) = \frac{\text{Displ. Length}}{\text{Displ.}^{1/3}} \times \begin{cases} 3.966 \text{ for Model} = 5.87 \\ .3057 \text{ for Ship} = \end{cases}$$

$$\text{Midarea} = 2131.5 \text{ Sq. Ft.} \quad \frac{\text{Midarea}}{\text{Breadth}^2} = \delta = .435$$

Prismatic Coeffs.: Forebody = .601 Afterbody = .719 Ship = .660 $\frac{\epsilon}{\;} = 1.42$

Analysis of Ends: $(1.0 - C_p)\ \epsilon = .399$ $\rho = .281$ $\lambda = .320$

$$(C) \text{ For Model} = \frac{\text{Resist. in Lbs.}}{(\text{Speed in Kts.})^2} \times \frac{226.4}{\text{Displ.}^{2/3}} = \frac{\text{Col. 3}}{\text{Col. 4}} \times \left\{ \frac{11.32 \times 2}{\text{Displ.}^{2/3}} = .4961 = F_r \right\}$$

$$\text{E.H.P.} = C \text{ for Ship} \times \text{Speed}^3 \times \frac{\text{Displ.}^{2/3}}{427.1} = \text{Col. 11} \times \text{Col. 13} \div \left\{ \frac{427.1}{\text{Displ.}^{2/3}} = .5525 = F_e \right\}$$

Temp. of Water 67°
Temp. Factor F_t=1.017

$\frac{V}{\sqrt{L}}$	Model: Speed Ft. Per Min.	Model: Resist. in Lbs.	Model: $\left(\frac{V}{\sqrt{L}}\right)^2$	Model: (C) $F_t \times$ Col. 3 $\div$ Col. 4	(C) Correction: From Curves for S=1.0	(C) Correction: Corrn. $\times$ (S) $\times F_t$. 6.60	(C) for 400′ Ship = Col. 5 — Col. 7		Ship: (C) Correction for Length from Curves	Ship: (C) for Ship = Col. 8 + Col. 10	Ship: Speed in Kts. = Col. 1 $\times \sqrt{\text{Len.}}$	Ship: Speed³	Ship: E. H. P. = Col. 11 $\times$ Col. 13 $\div F_e$
Col 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14
0.30			.0900		.0667								
0.35	112.15	.259	.1225	1.049	.0658	.434	.615		—.018	.597	8.088	529.0	572
0.40	128.18	.338	.1600	1.048	.0650	.429	.619		—.018	.601	9.244	791.0	860
0.45	144.20	.424	.2025	1.039	.0642	.424	.615		—.018	.597	10.40	1124 0	1214
0.50	160.22	.516	.2500	1.024	.0635	.419	.605		—.018	.587	11.55	1542.	1638
0.55	176.24	.616	.3025	1.010	.0629	.415	.595		—.018	.577	12.71	2054.	2145
0.60	192.28	.724	.3600	.998	.0623	.411	.587		—.018	.569	13.87	2670.	2750
0.65	208.30	.859	.4225	1.009	.0617	.407	.602		—.018	.584	15.02	3390.	3583
0.70	224.30	1.005	.4900	1.017	.0612	.404	.613		—.017	.596	16.18	4240.	4574
0.75	240.34	1.168	.5625	1.030	.0608	.401	.629		—.017	.612	17.33	5205.	5765
0.80	256.36	1.337	.6400	1.036	.0603	.398	.638		—.017	.621	18.49	6320.	7103
0.85	262.40	1.506	.7225	1.034	.0599	.395	.639		—.017	.622	19.64	7580.	8533
0.90			.8100		.0596								
0.95			.9025		.0592								
1.00			1.000		.0589								

foot, then the various constants for ship in salt water and model in fresh water will be as follows:

$$\text{Length Constant} \quad (M) = \frac{L}{\Delta^{1/3}} \times 0.3057 = \frac{L}{\delta^{1/3}} \times 3.966$$

$$\text{Skin Constant} \quad (S) = \frac{W}{\Delta^{2/3}} \times 0.09346 = \frac{W}{\delta^{2/3}} \times 15.73$$

$$\text{Speed Constant} \quad (K) = \frac{V}{\Delta^{1/6}} \times 0.5834 = \frac{V}{\delta^{1/6}} \times 2.047$$

$$\text{Resistance Constant } (C) = \frac{1.3115\ R}{\Delta^{2/3}\ V^2} = \frac{226.4\ R}{\delta^{2/3}\ V^2}$$

$$= \frac{101.33 V \times R}{33{,}000} \times \frac{427.1}{\Delta^{2/3}\ V^3}$$

$$= \frac{\text{E.H.P.} \times 427.1}{\Delta^{2/3}\ V^3}$$

$$\left[\frac{226.4\ R}{\delta^{2/3}\ V^2} = \frac{1.3115\ R}{\Delta^{2/3}\ V^2} \times 1.026 \times \left(\frac{2240}{1.026}\right)^{2/3} \right]$$

This (C) coefficient follows the laws of comparison and would therefore be strictly constant for any size of ship were it not for the fact that the frictional horsepower does not follow these laws.

The frictional resistance varies at something less than the square of the speed, and the coefficient of friction is higher for a short vessel than for a long one. As a consequence, the (C) calculated from the model tests will be greater than for the ship.

Unfortunately doctors differ as to the exact amount of the skin resistances, Froude taking a frictional coefficient for the 20-foot model of 0.01031 and for the 400-foot ship 0.00886 with a speed variation for both model and ship of

$V^{1.825}$ (i. e., R for wetted surface = S $\times V^{1.825} \times$ .00886).

At Washington the coefficient of friction for the 20-foot model is 0.00969 and for the 400-foot ship it is 0.00910, and the resistance is assumed to vary in the model as $V^{1.854}$ and for the ship as $V^{1.83}$.

The Washington constants for the ship are taken from the works of Tideman who, however, drew all his information from the original experiments of Froude.

The constants for the model in use at Washington were, however, obtained by careful tests at the Washington tank with facilities probably considerably better than Froude originally had at his disposal. It is my opinion, therefore, that by using the Washington model coefficients in conjunction with Froude's ship coefficients the closest possible approximation to the E. H. P. of the ship can be obtained. This will give C values very slightly higher than by Froude's coefficients.

The correction applied to (C) in passing from the model to the ship will of course be the difference in C value for skin friction as calculated by the coefficients for the model and for the ship.

They are therefore a function of the wetted surface and may be most conveniently tabulated for (S) = 1.0.

A diagram is given herewith showing (1) the value of (C_f) at (S) = 1.0 for a 400-foot ship and (2) the deduction from (C_f) of model for (C_f) of ship with (S) = 1.0 as calculated by using the coefficients of the various authorities for 10-foot and 20-foot models and 400-foot ship. On the same diagram, as an inset, is shown the percentage change in (C_f) value for other lengths of ships.

For greater convenience these values are also tabulated for the usual speed ratios.

(C_f) Differences Passing from Model to 400-foot Ship for (S) = 1.0

$\frac{V}{\sqrt{L}}$	20-Foot Model			10-Foot Model		
	Froude	Washington	Wash.-Froude	Froude	Ann Arbor	Wash.-Froude
0.40	.0470	.0382	.0418	.0695	.0430	.0650
0.50	.0454	.0375	.0410	.0670	.0442	.0635
0.60	.0440	.0369	.0403	.0650	.0453	.0623
0.70	.0428	.0364	.0398	.0633	.0464	.0612
0.80	.0418	.0359	.0393	.0618	.0471	.0603
0.90	.0410	.0355	.0389	.0605	.0478	.0596
1.00	.0402	.0351	.0385	.0594	.0484	.0589
1.10	.0395	.0348	.0382	.0584	.0489	.0583
1.20	.0389	.0345	.0379	.0575	.0494	.0577
1.30	.0384	.0343	.0376	.0567	.0498	.0572

The work of extension from model to ship may be arranged as shown herewith, the table being self-explanatory in great measure. Column 6 contains the (C) differences as above for (S) = 1.0 and these differences multiplied by (S) value, 6.49, and by a small temperature correction factor 1.017 are tabulated in column 7 and are subtracted from (C) value for model given in column 5 to give (C) for 400-foot ship in column 8. Column 9 is left blank as it is convenient for various purposes such as for tabulating (C) value with Froude or Washington correction.

The (C) correction in passing from one ship to another is of course of the same nature as that for passing from model to ship, and may be calculated from the diagram, but it is so nearly constant for all speeds that it can conveniently be tabulated for a speed ratio of say 0.80 and a value of (S) of say 6.50, thus:

Length	(C) Correction	Length	(C) Correction
100 feet	+ .0877	500 feet	— .0132
200 feet	+ .0406	600 feet	— .0233
300 feet	+ .0173	700 feet	— .0313
		800 feet	— .0398

The data given in the example herewith is for an exceptionally good model, and it is very unusual to have the (C) values below about 0.65. (S) values usually range between 6.0 and 7.0 and depend on draft ratio and (M) value to a considerable extent.

The draft ratio δ used expresses the ratio of depth of the rectangle of ship's breadth and mid area to that breadth.

What the Shipping Bill Is and Does

(*Continued from page* 606)

traveling at public expense, and all government supplies must be carried in American vessels wherever practicable.

Further paragraphs of the new bill define in some regards the relation of railroads and steamships. The provision of section 28 of the Merchant Marine Act of 1920, not yet enforced, requiring that goods for export and import enjoying preferential rates on American railroads, shall be conveyed in American ships, is clarified in some particulars.

National aid under contract will endure at least 10 years, as this is stipulated as the contract period.

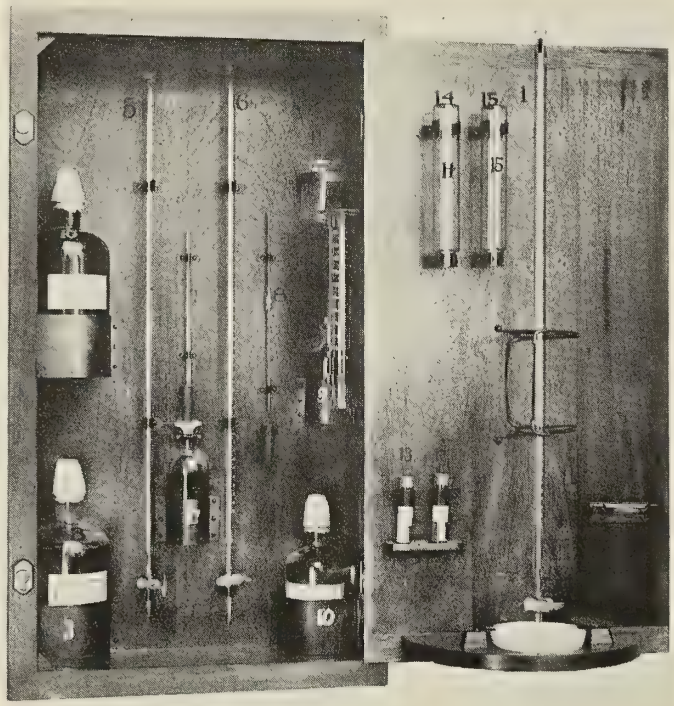
Cost of New Shipping Bill

But what will the new shipping bill cost year by year? Not more than $15,000,000 in total compensation the first year, is the estimate of experts of the Shipping Board, and not more than $40,000,000 a year at its maximum some years hence, when a merchant marine of 7,500,000 tons gross register, capable of carrying from 50 to 60 percent of our own exports and imports, has been properly developed in the foreign trade.

At present the Shipping Board reports a loss of nearly $50,000,000 a year on its 450 ships in operation. Considering both indirect and direct aids, including the deductions from income taxes, it is a just estimate that the cost of the bill at its highest figure will be kept well within $50,000,000. Moreover, it should be borne in mind that the upbuilding of a great merchant marine will produce increased income taxes from shipowners, employment for labor, and an expansion of our export trade, thus creating additional sources of public revenue. Still further, it is an axiom that private control and operation of our merchant ships are far more economical than government ownership and operation—even when the government experiment is being tried under the happiest of auspices.

Set for Testing the Alkalinity of Boiler Feed Water

A PRECISION feed water testing set, for which the makers, the Precision Water Treating Company, Brooklyn, N. Y., claim an accuracy in determining alkalinity to 1/10 of one percent and salt contained to 1/10 of one grain per gallon, has recently been made available to stationary power plant and marine boiler uses. In marine



Precision Feed Water Testing Set

work especially it is vitally important that the salt content of the feed water be under constant check, so that leaks in the condensers, pump lines, distillers and boilers may be determined at their inception.

It is also desirable to maintain water at the proper degree of alkalinity to prevent scaling and corrosion with resultant savings in fuel and lengthened periods of service between cleanings. The precision water testing apparatus is designed to perform convenient and accurate determinations in a quantitative manner. Demonstrations are made at the office of S. Aitken, agent of the company, Room F, 11 Broadway, New York.

International Shipping Conference Committee Reports

At the International Shipping Conference held in London last November committees were appointed to investigate exhaustively many of the questions discussed at the conference. As a result the following committee reports have been submitted to the president of the conference covering the subjects of Life-Saving Appliances, Wireless Telegraphy, Load Lines and the Subdivision of Passenger Liners.

Life-Saving Appliances

THE Committee was appointed under a resolution of the International Shipping Conference, passed in November, 1921, which defined the principles upon which any further consideration of that part of the problem of Safety of Life at Sea which more particularly relates to Life-Saving Appliances should be based. The first meeting was held in London on May 22; it was agreed that the Convention of London, 1914, should be taken as the basis of discussion, bearing in mind the principles underlying the report of the Merchant Shipping Advisory Committee, 1912. In the committee's opinion, a cardinal error was committed by the Government's signatory to this Convention in departing from the principles contained in this report and in substituting therefor other principles which failed in any degree commensurate with the anticipation of such Governments to save life after marine casualties.

To the main recommendations of that committee the International Shipping Conference adhered in their resolution of November, 1921, and with the disaster of the *Egypt* fresh in the committee's minds, it urges them upon our Governments.

Among the resolutions passed were: That the attention of the Board of Trade be drawn to the *Egypt* disaster and to the fact that the opinions expressed at the International Conference are thereby confirmed as follows:

(i) The Board of Trade referred, after the loss of the *Titanic*, the whole question of boats and life-saving appliances to the Merchant Shipping Advisory Committee.
(ii) That committee reported in favor of certain principles being adopted by the Board of Trade.
(iii) Had these recommendations been fully acted upon, subsequent experience under conditions both of war and of peace shows that loss of life at sea might have been diminished.
(iv) Nevertheless, the Government's signatory to the Convention of London proceeded upon other principles which shipowners then feared and which have proved to be detrimental to safety of life at sea.

That all Governments be accordingly invited to take immediate steps to revise the Convention in accordance with the Report of the Merchant Shipping Advisory Committee, 1912, as amplified by the recommendations of the committees of the International Shipping Conference concerned with safety of life at sea.

Wireless Telegraphy

(*a*) Amendments to the Convention of London

After consideration of the Articles of the Convention of London relating to wireless telegraphy, and having taken into account memoranda submitted on behalf of the German and Italian delegates, the committee recommends the following amendments:

Article 32.—It was agreed—

1. That in order to allow for partial as well as total exemption of coasting and short sea trade vessels, the opening sentence of the second paragraph of Article 32 should be amended.

2. That paragraph 2 (sub-section 1) should be amended by the substitution of the words "200 sea miles from the nearest coast" for the words "150 sea miles from the nearest coast."

Article 34.—It was agreed that the following words be added to Article 34 after the words "High Contracting parties" in the last paragraph but two:

"An automatic calling apparatus shall be deemed efficient if it can take the distress signal and the safety signal and reaches 80 percent efficiency in an open sea test under service conditions.

"The shipowner may employ a navigating officer or other member of the crew in lieu of a wireless operator, provided such person has qualified for a special certificate of competence to receive and transmit wireless signals in connection with safety of life at sea. Such person shall not be required to keep any specified watch on the wireless instruments, provided that he is always available in the case of emergency and that the continuous watch when required by the Convention is kept by automatic or human agency."

Article 35.—It was agreed that the first paragraph of this Article should be altered to read as follows:

"The Radio Telegraphic Installation required by Article 31 above shall be capable of transmitting clearly perceptible signals for the purpose of safety of life at sea from ship to ship over a range of at least 100 sea miles by day under normal conditions and circumstances."

(*b*) General Recommendations

1. *Basis of obligation to carry Wireless.*—We have considered this question, and find that the basis provided in Article 31 of the Convention is logical and satisfactory; this number should refer to those actually on board, in accordance with the Convention, and not to the number of those for whom the ship may be certificated.

2. In the event of the Government of any State signatory to the Convention exercising the powers of Article 32 in the sense of differentiating between passenger and cargo vessels under sub-section 1, we recommend that the obligation to carry wireless shall not in any event be placed upon passenger vessels unless they have 100 passengers on board.

3. *Automatic device.*—The most immediate need in connection with the use of wireless is the development and approval of an automatic device. Some doubt, however, having been raised on the committee as to whether the apparatus in its present form was sufficiently developed to allow of its early or immediate adoption, they invited technical representatives of the different wireless companies in Great Britain to give evidence on this point. Evidence was accordingly received from Commander A. J. Slee, representing the Marconi Company, and from Mr. R. Ferguson, on behalf of the Radio Communication Company. Mr. H. Machin, manager of Siemens Bros., Limited, was unable to attend, but he has since told the committee that, while he believes it to be impossible for an automatic device to record the existing S.O.S. signal, he hopes that with an altered distress signal an effective automatic device could be put on the market.

The representatives of the Marconi and Radio Communication Companies stated that, if the alarm call were altered, there would be no difficulty in providing an apparatus to take such altered signal with an even greater percentage of efficiency than that of an instrument described.

It is not reasonable, however, to expect wireless companies to submit for trial or embark upon the manufacture of these instruments until the conditions of their trial and acceptance by the authorities have been definitely laid down.

It was accordingly resolved:

(a) That the Governments of the various maritime States be urged again to apply themselves to the immediate approval of an automatic device to receive emergency calls.

(b) That with this object the purpose which such instrument is required to meet should be restricted to the taking of emergency calls under ordinary service conditions at sea; and

(c) That existing devices should at once be re-tested under the same service conditions with the object, if possible, of approving immediately a device which will respond under normal service conditions at sea to the existing distress call, *but that if this is not possible, active steps should be forthwith taken to agree internationally on a new distress call which is capable of being so taken.*

4. *Wireless as a Navigational Duty.*—The committee recommends that apprentices should be trained in wireless, as in navigation, and that existing masters and navigating officers should be encouraged to take a wireless course to secure their certificates, and that each Government should institute a special examination and certificate of competence to operate the instrument for ship's service, including safety of life at sea.

5. *Directional Wireless.*—The committee attaches the greatest importance to the development of this branch of wireless telegraphy, but thinks it necessary to point out that a navigational instrument which will add to the safety and decrease the cost of running ships is of such commercial importance, that shipowners may without risk be left to choose their own time and method for its adoption, and that the fewer Government regulations that are applied to it the more satisfactory and the swifter will be its development. In the same way they desire to encourage shipowners to make use of wireless for the receipt of time and weather signals, but are strongly of opinion that this is a point upon which Government interference would be quite inappropriate.

Life-Saving Appliances

It was reported that the British Government had again remitted to the Merchant Shipping Advisory Committee of the Board of Trade the question of life-saving appliances, with an instruction to revise the appropriate sections of the Convention of London in accordance with more recent experience. On this subject, the Committee states: "We have already stated our opinion that the principles enunciated by this Committee, which were reached in 1912, were sound, and that every successive failure of the regulations adopted by the various Governments in contradiction of their report has only served to confirm the wisdom of their first decisions. We here desire to express the hope that the Merchant Shipping Advisory Committee will reaffirm the principles then established, as amplified in the terms of the resolution passed by the International Shipping Conference, and which it has been our task further to interpret. In particular, we endorse the principle that boats in excess of those which can readily be launched are an encumbrance and a danger, and that in a disaster many lives may be saved by light and handy buoyant apparatus.

"Since the *Titanic* a series of disasters at sea proves the danger of encumbering the decks with boats which cannot be launched, and the need for buoyant apparatus which can easily be handled or will float off when the ship sinks and give support till rescue comes.

"These general principles have been translated into specific recommendations for the amendment of the Convention by our technical sub-committee in their report, which we attach, and unanimously commend to the Conference.

"We desire to re-affirm the Resolution of the International Conference:

"'That inasmuch as International Conventions become valueless, if any contracting Government applies different rules, whether less or more severe, to all ships visiting her ports, the attention of Governments signatory to the Convention should at once be called to instances in which the international accord of the Convention has been disturbed by particular regulations in order that the disturbance may be removed.'"

The reports are signed by the following: A. G. Anderson (chairman), Great Britain; Chas. A. Bartlett, Great Britain; Ing. E. Benvenuti, Italy; David Boyd, Great Britain; Jas. Carnegie, Belgium; E. Falcoz, France; H. Garde, Denmark; John R. Hobhouse, Great Britain; O. A. Nordborg, Sweden; W. H. J. Oderwald, Holland; N. Ohtani, Japan; I. Hysing Olsen, Norway; L. Peskett, Great Britain; Alejandro de la Sota, Spain; Warnholtz, Germany; J. Rypperda Wierdsma, Holland; P. Maurice Hill (secretary), Great Britain.

International Load Line

The International Shipping Conference, held in London on November 23, 24 and 25, 1921, passed the following resolution:

"That this conference, representative of the shipping industry in every part of the world, is of the opinion that the time is opportune for the introduction of International Load Line Regulations.

"That with this object a committee be appointed to investigate and determine the form of regulations capable of International acceptance.

"That such committee consist of one member appointed by representatives of each country, and that the registration bureaus and the classification societies be invited each to appoint a representative on the committee, and that the committee appoint a secretary."

In accordance with the terms of reference as shown above, the committee held its first meeting on May 22, 1922.

It was agreed that the Report No. 10, which had been submitted to the International Shipping Conference in November of last year, should be taken as the basis of discussion, together with the Memoranda received from other countries, namely: (1) Scandinavia, dated Copenhagen, April 25, 1922; (2) Germany, dated April 26, 1922; (3) Holland, dated April 24, 1922; (4) Holland, undated; (5) Japan, dated May 16, 1922.

In the course of general discussion, it was recognized that the question of allowance for freeboard for certain classes of superstructure was closely associated with the question of tonnage measurement, and that certain anomalies in the assignment of freeboard had arisen on account of the preferential treatment of spaces exempted from tonnage measurement. It was recognized, however, that this question of tonnage was affected by the action of Port Authorities and others, and it is necessary for a general agreement to be arrived at.

Enclosed Spaces

As regards the question of freeboard assignment, it was recognized that if a space was totally enclosed, it should have a full allowance for freeboard, and that otherwise the allowance for freeboard should be varied in respect of the means of closing adopted.

Discussion also took place on the basic tables of freeboard, and the general opinion was that the freeboard at present required for the usual type of vessels was satisfactory, and that, as regards small vessels of usual type, no increase of freeboard appeared necessary.

It was felt that the present freeboards of flush deck vessels required some increase, and it seemed to be generally agreed that all flush deck vessels should be provided with a forecastle or, alternatively, if this were not done, there should be a greater increase of freeboard. This increase of freeboard forward might perhaps be obtained by the adoption of suitable sheer.

Particular attention was directed to the standard of strength proposed by the load line committee, and it was observed that in the Japanese regulations on load line recently issued, the load line standard had been adopted with only slight modification. Opinion was divided on the question, some of

the delegates being in favor of the adoption of the proposed standard, others considering that the recognized authorities should set up suitable standards.

The conditions of assignment of freeboard, as proposed by the load line committee, were considered at some length. The committee was satisfied that the greater part of these conditions had already been adopted by the action of the classification societies, and that it would be preferable at the present time to confine their attention to the main points of the freeboard question rather than to detail the points involved in these clauses.

Wood Deck Cargoes

Reference was made to the determination of freeboard for vessels carrying wood deck cargoes, and attention was drawn to the recent report of the deck cargoes committee of the International Shipping Conference on this subject. It was observed that this report did not agree with the observations of the load line committee on this question, and that the rules already proposed in the report referred to provide for the assignment of freeboard for vessels carrying such cargoes by allowances based on the freeboard regulations for a steel steamer.

This committee, in common with the previous committees on subdivision and on deck cargoes, experienced difficulty in regard to variations of freeboard permitted for different seasons of the year and for different geographical regions. They confirmed the opinion already expressed by the other committees that it was very necessary that the Governments of maritime countries should take common action to define the summer and winter season, not only for the North Atlantic region, but also for other regions of the globe where similar treatment might be suitably and safely granted.

It is to be observed that when this question of regional variation is under discussion, special regard should be paid to certain waters, which might be regarded as inland seas, such, for example, as the Baltic, which is sometimes regarded as suitable for favored terms in respect of maritime legislation.

Not Retrospective

The committee was agreed that the application of those rules would only affect the freeboard of ships *to be* built, and that the proposals should not be made compulsory retrospective to vessels already in existence. They were further of opinion that these rules were framed for international ocean-going trade.

It was observed that the rules proposed by the load line committee did not make provision for the assignment of freeboards to vessels of exceptional types or forms, and it is presumed that some special schedule of requirements in regard to such vessels would need to be laid down at a future date.

The committee then proceeded to deal in detail with the report of the load line committee, and, in regard to the question of stability, were of opinion that it was only necessary to state that the assigning of a freeboard mark did not give any guarantee as regards the stability of a vessel. The clause that requires a master to exercise authority in this respect should, therefore, be deleted. There was, however, an opinion expressed that certain countries might find it desirable to retain this clause or to substitute for it any other that conformed with the law of the country.

The definition of freeboard and the methods of marking were generally agreed to.

The definitions of standard types of vessels and of the principal dimensions were generally concurred in, except that some opinion was expressed that it was desirable in all these technical regulations to have a uniform definition of length. The committee was of opinion that in vessels with cruiser sterns, the length should be taken to the center of the rudder stock, or to 96 percent of the total length overall, whichever was the greater, subject, however, to a reservation on the part of the Norske Veritas and the Technical Adviser for Denmark as to this altered reading.

The characteristics of standard vessels were next considered, and the ratio of length to freeboard depth and standard round of beam were agreed to, and the bases of the table for determination of freeboards (Article 8) were also concurred in.

The committee proceeded with the discussion of the correction to be made to the freeboards for departures from the standard, and were generally in agreement with the corrections necessary for the variation of length to depth ratio for sheer correction, and for round of beam correction. The question of immersion of the freeboard deck, as contained in Article 16 of the load line committee's report, met with the approval of the committee.

Standard Height of Superstructures

The question of the standard height of superstructure was discussed by the technical sub-committee, and it was agreed that:

The last clause of Article 7 (d) of the load line committee's report should be amended to read as follows:

(a) The standard height in feet of superstructures which are fitted abaft amidships is 3 feet when the length of the vessel does not exceed 100 feet and 5 feet when the length of vessel is 350 feet and above.
(b) The standard height in feet of superstructures which are fitted forward of amidships is 5 feet when the length of the vessel does not exceed 100 feet and 7 feet 6 inches when the length of the vessel is 350 feet and above.
(c) For intermediate lengths the standard height is to be obtained by interpolation.

This recommendation sets up a standard height for after superstructures, as well as for forward superstructures.

The sub-committee also considered the most important subject of the basic freeboard tables, as contained in the appendix to the load line committee's report. The committee was generally in agreement with those tables for flush deck vessels, but the representative of the Norske Veritas considered that the freeboard should be larger for such vessels.

Considerable discussion necessarily arose on Article 13 of the load line committee's report, dealing with the allowance to be granted for superstructures with various types of closing apparatus, and the committee was of opinion that the allowances, as contained in Table 2 of the load line committee's report, should be modified in accordance with the following recommendations:

In regard to the question of closing appliances, it was agreed that 100 percent allowance should be given to shelter deck vessels with a tonnage opening closed with closing appliances (storm boards full height), fitted at each end of the tonnage well. It was agreed that full allowance should be given for bridge houses which were closed by Class 1 appliances at the fore end, and either Class 1 or Class 2 appliances at the after end, in conjunction with open scuppers. In the case of a combined poop and bridge, it was agreed that the full allowance should only be given when the openings, if any, were closed with Class 1 appliances. Portable plates, whether secured by bolts through the bulkhead plating, or by hook bolts, should be included in Class 2 closing appliances, but that storm boards of half height should be regarded as non-existent.

Standard Sheer

The question of a standard sheer was investigated, and the recommendations of the load line committee were agreed to, subject to a reservation on the part of one of the Dutch representatives. The Norwegian and Swedish representatives also made a reservation in regard to the case of shelter deck vessels having a tonnage opening aft, and were of the opinion that in such cases the sheer should be measured relative to the shelter deck and not to the upper deck.

The committee had under consideration the modifications which could be made to the regulations for the assignment of freeboard for wood and composite vessels, and they recommend that:

(1) The length shall be measured in the same manner as for a steel vessel.
(2) The breadth shall be measured to the outside of the planking amidships instead of the outside of the frame amidships.
(3) The freeboard depth to be used with the Tables is the vertical distance amidships from the point where a continuation outwards of the upper surface of the freeboard deck intersects the outer surface of the shell or planking to the level of the top of the keel in steel and iron vessels, and to the lower edge of the rabbet of the keel in wood and composite vessels. When the form of the lower part of the midship section is of a hollow character, the depth is, however, to be measured to the point where the line of the flat of the bottom continued inwards cuts the side of the keel. When the rise of the floor exceeds 1½ inches per foot of a half breadth, the freeboard depth may be reduced by half the difference between the total rise of floor at the half breadth and the total rise at the standard rate of 1½ inches per foot. Two and a half inches per foot of half breadth is, however, to be the maximum rate of rise on which an allowance is to be made.

The committee was also of the opinion that this definition of depth might with advantage be substituted for the definition given in Article 6 (c) of the load line committee's report.

It was agreed that the computation of the freeboard of sailing vessels should be in accordance with the rules for steamers, such an addition being made as would bring the assignment into practical agreement with the present summer freeboards for such vessels. The summer and winter marks could be retained as at present.

Non-propelling barges should be treated on the same basis as that laid down for sailing vessels.

The committee was very much exercised with the definition of the term "steamer," as contained in Article 1 (a) of the load line committee's report. They were of the opinion that consideration should be given to the question of speed and power, and suggest that some minimum brake horsepower should be associated with the load displacement of the vessel. It was not possible at present to determine a satisfactory standard, but it is recommended that this subject be left over for further study.

The report was signed by the following: Belgium, Christian Sheid; Denmark, J. A. Koerbing; France, E. Patry; Germany, Warnholtz; Great Britain, Walter J. Chambers and H. B. Hooper; Holland, W. Royer; Italy, C. Camalich; Japan, W. Yokoyama; Norway, Halfdan Ditlev-Simonsen; Spain, Alejandro de la Sota (for Bilbao Shipowners' Association); Sweden, O. A. Nordborg; for Bureau Veritas, E. Patry; for Det Norske Veritas, J. Bruhn; for the British Corporation, Benson Taylor; for Lloyd's Register, W. S. Abell.

The Subdivision of Passenger Liners

The International Shipping Conference, held in London on November 23, 24 and 25, 1921, passed the following resolutions:

(1) That international uniformity in regulations for the subdivision of passenger vessels is necessary.
(2) That the International Code of Regulations contained in the Convention of London is incomplete, unsatisfactory and demands immediate revision.
(3) That any revision of the Convention must be such as to secure effective administration of the regulations by all the signatories, to the end that certificates of safety may have international validity.
(4) That any revision of the Convention must have regard, in conformity with Article 17, to the nature of the services in which the vessels are engaged and must be consonant with the economic conditions under which they are operated.
(5) That a committee of the Conference shall be appointed to consider and report in due course on the manner in which the Convention should be modified.

In accordance with the terms of reference contained in the last of these resolutions, the committee held its first meeting on May 8.

It was agreed that the Report 11a, which had been submitted to the International Shipping Conference in November of last year, together with the letter of December 14, 1921, and the memorandum dated April, 1922, should form the basis of discussion. (See Appendices.)

The Factorial System Preferred

On the relative merits of the graduated and factorial systems for regulating the spacing of bulkheads, it was agreed—

(a) That the factorial method should be adhered to, especially in view of the fact that such procedure would accord with the attitude already taken up by various Governments and would therefore facilitate final agreement.
(b) That below a certain length of vessel it was not economically possible to provide a one-compartment standard of subdivision throughout the length.
(c) That greater simplicity and directness of method for flooding calculation was desirable, and that a code or codes might advantageously be adopted from which floodable length curve, draft penalty, and index of permeability could be derived, provided that the codes used by different countries were guaranteed to give results differing by not more than 2 to 3 percent, and provided that shipowners had the option of employing a method involving the use of first principles in the calculations.
(d) That a criterion, based on mean permeability of all spaces, as suggested by the bulkheads committee was unacceptable.
(e) That provision in cargo carrying vessels must be made for a minimum length of hold, but as to the precise minimum there was some difference of opinion; the German delegation stating that the economic requirements of their mercantile marine did not call for a length of main hold as much as 80 feet.

At the conclusion of this general discussion the committee adjourned after appointing a technical sub-committee. This sub-committee held four sessions, and on May 12 presented its report to the plenary committee. At the same time a letter was received by the chairman from Mons. Nizery stating that the French delegates, who had attended all the meetings up to May 12, could no longer collaborate in the work of the committee.

Recommendations

The recommendations or findings adopted either absolutely or with reservations as recorded in this report fall into two parts.

I. Those adopted when representatives of all the delegations were present.

II. Those adopted when representatives of all the delegations, excepting only the French, were present.

They are:

Part I

(1) That in vessels below a certain length it is not possible, consistently with their economic use, to space the bulkheads so closely that the vessel will float with any one compartment open to the sea.

(2) That greater simplicity and directness of method for flooding calculations is desirable, and that a code or codes, including that recommended by the British bulkheads committee, without correction for form, might advantageously be employed from which floodable length curve, draft penalty and index of permeability could be derived, always provided that the codes used by different countries were guaranteed to give results differing by not more than 2 percent to 3 percent from an agreed standard, and provided that shipowners had the option of employing a method involving the use of first principles in the calculations.

(3) That the factorial method for regulating the spacing of bulkheads should be adhered to, especially in view of the fact that such procedure being in accord with the attitude already adopted by various Governments would facilitate final agreement.

(4) That a criterion of service based on the mean permeability of all spaces included in the gross tonnage as suggested by the bulkheads committee is unacceptable.

(5) That in vessels carrying mainly cargo with a nominal number of passengers, whether above or below the bulkhead deck, provision must be made for a hold of a minimum length, but opinion as to the precise minimum was not unanimous, the German delegation considering that 80 feet, the minimum suggested by the British delegates, was in excess of the requirements of their own trade.

(6) That the curve *B*, as given in Report IIa is acceptable as satisfying both safety and economic requirements. (This is subject to the reservations by the German and Japanese delegations.)

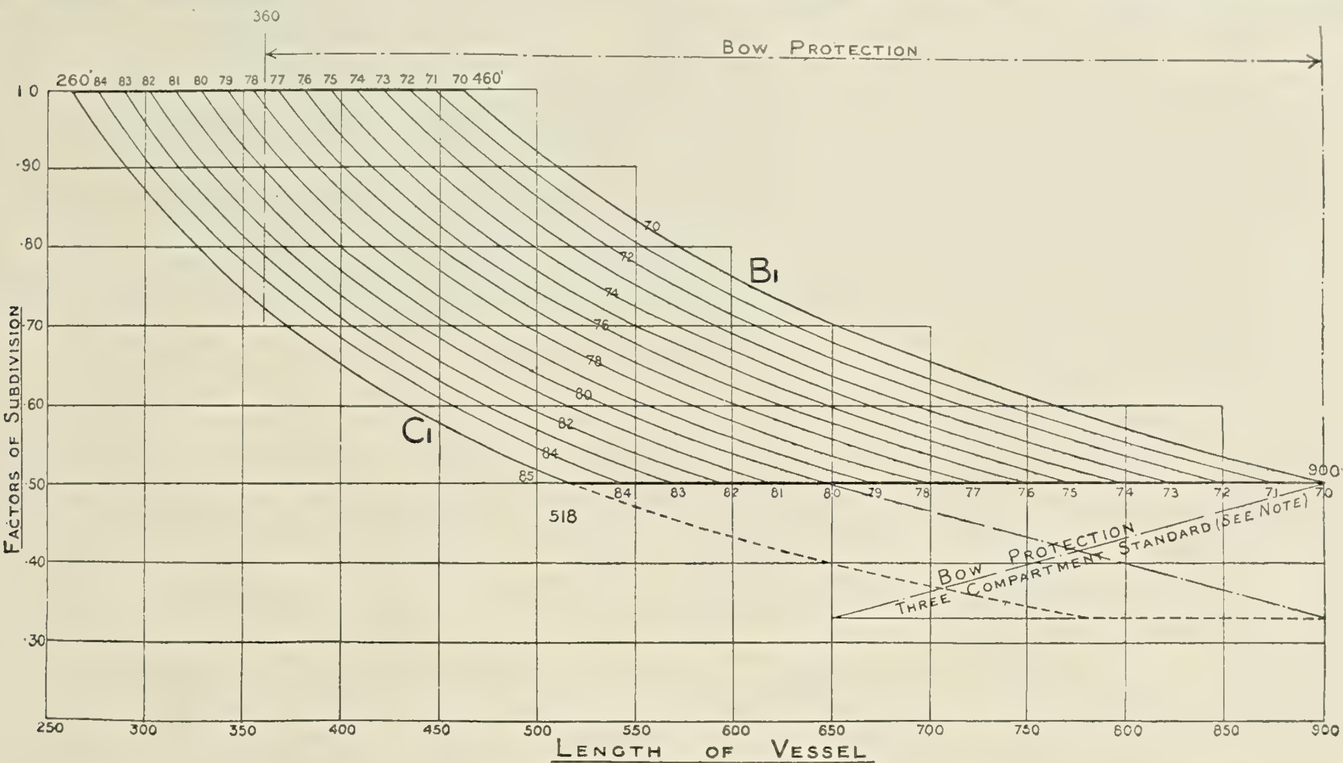
the same are carried above or below the bulkhead deck.

(11) That the Convention curve *C* as amended is applicable to the highest type of vessel primarily engaged in the carriage of passengers.

(12) That the main factor of the criterion might reasonably be based on the permeability of the vessel below the bulkhead deck.

(13) That in addition it would be necessary to introduce a correcting factor based on the total number of passengers carried in the vessel, whether below or above the bulkhead deck, in order to provide for the varied distribution of passengers and of space per passenger.

(14) That this factor might be derived from some specific volume per passenger so applied that where the



1. This diagram does not apply to vessels in the "Home and Coastal" services having length below 360 feet.
2. Vessels with criterion permeability values of 70 percent or below, to have factors of subdivision derived from curve B1.
3. Vessels with criterion permeability value of 85 percent and above to have factors of subdivision derived from curve C1.
4. Vessels with criterion permeability values between 70 and 85 percent to have factors of subdivision obtained by direct interpolation from the diagram.
5. All vessels 360 feet and above to have bow protection of either a "two" or "three-compartment" standard, and the remainder of the vessel will in no case exceed a "two-compartment" standard.
6. Vessels of 360 feet in length, with criterion values less than given by formula: $u = 104.5 - \frac{L}{13.3}$ to have "two-compartment" bow protection only.
7. Vessels of 360 to 460 feet in length, with criterion values equal to or greater than given by formula: $u = 104.5 - \frac{L}{13.3}$ to have "two-compartment" bow protection, with the remainder of vessel to diagram.
8. Vessels of 460 feet in length and above, to have "two-compartment" bow protection with remainder of vessel to diagram, except in vessels 650 feet and above, with criterion values equal to or greater than given by formula: $u = 105.4 - \frac{L}{25.4}$ where the bow protection will be of a "three-compartment" standard and the remainder of vessel a "two-compartment" standard.
9. A "two-compartment" bow protection signifies that the length of fore-peak and No. 1 hold will together not exceed the floodable length forward.
10. A "three-compartment" bow protection signifies that the length of fore-peak and Nos. 1 and 2 holds will together not exceed the floodable length forward.

Diagram of Factors of Subdivision for Foreign-Going Passenger Vessels

(7) That the curve *C* as laid down in the Convention should be adhered to for vessels up to 550 feet in length, the curve being then limited by a horizontal line drawn at 0.45 factor of subdivision, as shown in Appendix *J*.

(8) That when in any vessel a factor of subdivision of 0.40 or less is complied with, a special mark should be placed on the Safety Certificate to this effect.

(9) That the proposals contained in the Report IIa for special bow protection are satisfactory.

Factors of Subdivision

(10) That the curve *B* is applicable to vessels carrying mainly cargo with a nominal number of passengers, whether

volume of the space set apart for passengers below the bulkhead deck is greater than the product of the total number of passengers on board multiplied by some specific volume per passenger, the criterion could be applied without correction, but that where the total number of passengers multiplied by some specific volume per passenger exceeds the volume of the space set apart for passengers below the bulkhead deck such greater volume should, for purposes of the criterion, be substituted for the lesser volume.

Note.—The French delegation expressed their dissent from Recommendations 12, 13 and 14.

The Norwegian delegation desired further opportunity to test the practical application before concurring.

(15) That Articles 2 and 3 of the Convention should be read to mean that any ship which was not at any point in her voyage at a distance of more than 200 sea miles from a sea coast might be exempted from the provisions of the Convention.

Part II

(16) That as a provisional basis for further study the nominal number of passengers to be associated with curve B_1 should be $\frac{L^2}{1,000}$, where L is the length of the vessel in feet, and that, if possible, this allowance should be embodied in the scale factor of the criterion.

(17) That subject to international agreement on seasonal limits, the subdivision load line should be subject to seasonal variations, these being dealt with as proposed in the International Committee's Report in connection with deck cargoes.

Determination of Permeability

(18) That the British suggestion for the determination of permeability contained in Appendix VII was satisfactory and should be accepted, but that the passage commencing line 6 should read as follows:

"Where $h =$ the mean depth below the bulkhead deck of the 95 percent spaces as defined in the present Board of Trade Regulations (exclusive of double bottom, peaks and tunnels) reduced in the proportion which the mean length of such spaces bears to the *mean* length of the vessel measured between the forward machinery space bulkhead and the collision bulkhead, or between the *mean* position of the aft machinery space bulkhead and the *mean* position of the after peak bulkhead. The mean depth is to be measured from top of deck to top of deck at center line.

$H =$ the depth of the vessel from the top of keel to the margin line midway between the end of the machinery space and the forward or after end of the vessel.

$c = o$ for forward end, 1 for after end in single-screw vessels, and 2 for after end in twin-screw vessels, *and 3 for triple-screw vessels.*"

(19) That the mean length of any compartment should not exceed the permissible length, and that no compartment having a mean length of less than 25 feet should be considered as forming part of the watertight subdivision of the vessel.

(20) That more than two alternative load lines should be permitted.

(21) That Article IX (1) of the Convention should be amended to read as follows:

"When the factor of subdivision is equal to or less than .5 it may be doubled in order to give at any point of the ship's length the total length of two adjacent compartments; but, in that case, the length of the shorter compartment of any pair should not be less than one-quarter of the total length *of the two adjacent compartments.*"

Steps and Recesses

(22) That the Regulations for steps and recesses as contained in the Convention should be amended to read as follows:

Recesses.

"That no part of the sides of the recesses should be nearer to the side of the ship than 6 feet, or one-sixth of the breadth, whichever is the greater."

Steps.

"That, whatever the factor of subdivision, the total length of the step in any bulkhead should not exceed 2 percent of the ship's length, but that where the factor of subdivision is .5 or less, the length of the steps may be increased by 3 m., or 10 feet."

The report was signed by the following: Thos. Free, Australasia; A. Leenaers, Belgium; A. S. M. Nicholls, Canada; J. A. Koerbing, Denmark; A. M. Nizery, France; M. Warnholtz, Germany; Kenneth S. Anderson, Great Britain; W. J. Oderwald, Holland; E. Benvenuti, Italy; N. Ohtani, Japan; J. Bruhn, Norway; Michael J. Hayes, Spain; Dan Broström, Sweden.

Appendix VII

Determination of Permeability

It is proposed (somewhat as suggested by the Board of Trade in their Memorandum M. 30084) that the average permeability of the hold spaces below the bulkhead deck should be determined by the formula—

$$\text{Permeability} = 63 + 32\frac{h}{H} + c.$$

Where $h =$ the mean depth below the bulkhead deck of the 95 percent spaces, as defined in the present Board of Trade Regulations (exclusive of double bottom, peaks and tunnels), reduced in the proportion which the mean length of such spaces bears to the length of the vessel measured between the forward machinery space bulkhead and the collision bulkhead, or between the aft machinery space bulkhead and the after peak bulkhead. The mean depth is to be measured from top of deck to top of deck at center line.

$H =$ the depth of the vessel from the top of keel to the margin line midway between the end of the machinery space and the forward or after end of the vessel.

$c = 0$ for forward end, 1 for after end in single-screw vessels, and 2 for after end in twin-screw vessels.

The permeability of machinery spaces is to be taken at 80 percent for steamships and 85 percent for ships fitted with internal combustion engines.

In cases where the "two-compartment" standard of subdivision is required and the permeabilities of two adjacent compartments are different, the length of the compartments are to be obtained by the formula—

$$\frac{u_1}{u_2}(l - l_1)$$

as given in paragraph 18 of the Board of Trade present regulations for the construction of passenger vessels.

Appendix B

The Criterion of Service referred to in paragraphs 35, 38 and 40, in the marginal note on the factor of subdivision diagram, Appendix VIII of the Chamber of Shipping Technical Sub-Committee Report (11A), and explained in the circular letter, dated December 14, 1921, is as follows:

$$u = u_1 + P,$$

where

$u =$ Criterion of Service permeability.

$u_1 =$ the mean permeability of spaces below the bulkhead deck (derived from formula from the longitudinal middle line section of the vessel). (See Appendix A.)

$P =$ a correction for the passenger capacity above the bulkhead deck.

A suitable evaluation of the last term in the equation was found to be—

$$P = \frac{150,000\ N}{L^2 B}$$

where

$N =$ number of passengers accommodated above the bulkhead deck.

$L =$ subdivision length of vessel.

$B =$ subdivision breadth of vessel.

The complete formula, therefore, for Criterion of Service may thus be expressed:

$$u = u_1 + \frac{150,000\ N}{L^2 B}$$

Appendix C

Memorandum Circulated to the Members of the International Committee on Subdivision of Passenger Vessels in April, 1922, for the Meeting of the Committee Held in May, 1922.

It is anticipated that the committee will, in the first instance, proceed to a general discussion of the Report of the Technical Sub-Committee of the Chamber of Shipping dealing with the subdivision of passenger vessels (11A), which was handed to the representatives of the various countries at the preliminary meeting held on November 25, 1921.

After such general discussion, it is suggested that the following specific questions involved in the Report should be considered:

(1) Whether the general nature of the curve C_1 contained in the Report is acceptable for the highest type of vessels primarily engaged in the carriage of passengers.

It should be observed that curve C_1 is almost identical with the curve C recommended by the bulkheads committee, which has

(*Continued on page* 656)

Motorship Bintang, Owned by the East Asiatic Company

Small Motor Cargo Ships for the Eastern Trade

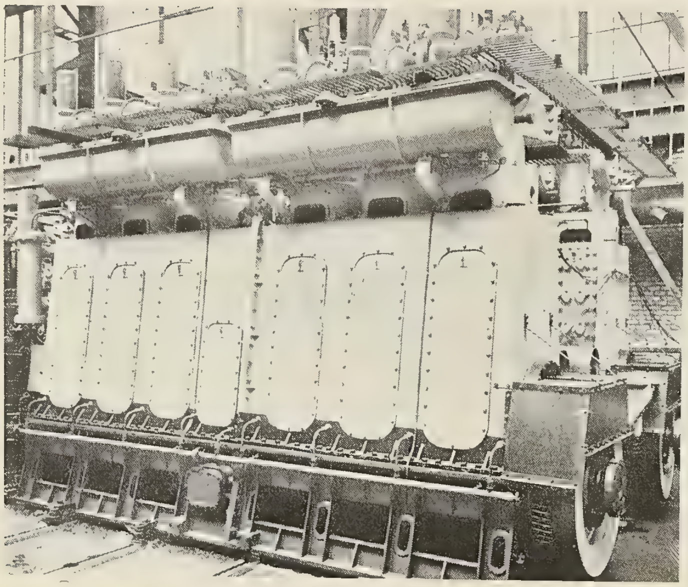
Motorships of About 2,000 Tons Capacity Equipped with Twin Screw Propelling Machinery—Auxiliaries Are Electrically Driven

By Our Special London Correspondent

WHILE chief interest in European shipping circles has lately centered around the numerous motorships of comparatively large size that have been turned out, varying mainly from 6,000 tons to 14,000 tons deadweight, the problem of the application of the oil engine to smaller vessels for specialized services has not been overlooked. In the opinion of many operators, there is a particularly wide field for this class of craft, on account of the low fuel consumption of the Diesel engine, which permits of a large radius of action without the fuel bunkers occupying too large a portion of the available space on the ship, as may be the case with small steamers trading on long routes. In some of these vessels, perhaps the majority, single screw machinery of the long stroke type has been installed, since the power required seldom exceeds 1,000 shaft horsepower. Probably the tendency will be increasingly in this direction, but it is noteworthy that two interesting small motorships, which have just been completed, are both equipped with twin screw plants, although the power does not exceed that stated above.

These two vessels are both destined for service in the East and will not return to European ports except for periodical survey. It is a proof of the confidence which shipowners now place in the oil engine, that such ships are allowed to

Twin Screw Motorship Dumra, Built for the British India Steam Navigation Company



One of the 500 Brake Horsepower Diesel Engines Installed in the Dumra

proceed to their destination immediately after the trials, and will trade for several years on end in parts of the world where possibilities of repairs being effected to the machinery are extremely small.

Vessel for Eastern Coastal Service

One of these new motorships was built in Denmark, to the order of the East Asiatic Company, whose fleet now consists almost entirely of oil engined vessels. The *Bintang,* as she is named, is intended for coastal service in the East, and is 284 feet in length, having a beam of 44 feet and a depth of 28 feet.

She is equipped with two six-cylinder Diesel engines of the Burmeister & Wain type, with cylinders 19¾ inches bore, and 26 inches stroke. Each develops about 700 indicated horsepower, or 525 brake horsepower, when running at about 150 revolutions per minute, and the design is practically identical with that of the larger Burmeister & Wain engines, built in sizes up to 3,200 indicated horsepower. Although there is much to be said for the propulsion of ships of this size, by single screw machinery, it is claimed that owing to the higher speed of revolution possible with a twin screw plant, such an arrangement allows of an actual reduction of machinery weight, as compared with the single screw ship. On the other hand a marine engineer naturally prefers machinery operating at low speed, while the advantage of having only six cylinders in a ship instead of twelve is self-evident.

The *Bintang*, as is usual on most modern oil engine vessels, is equipped with electrical auxiliary machinery, two Diesel driven generating sets being located in the engine room. The exhaust gases are discharged through pipes alongside the mast, and no funnel is provided.

The Dumra Has Passenger Accommodations

The second small motor vessel which has lately been completed is a more interesting type than the *Bintang.* This is the *Dumra* which was constructed for the British India Steam Navigation Company, for their service on the West African coast. The capacity of the hold amounts to just over 2,000 tons, in addition to which first and second class cabins are arranged amidships around the machinery casing for about 40 passengers. The vessel has a length of 280 feet, the beam being 43 feet 6 inches, the draft 17 feet 6 inches and the molded depth 24 feet. The loaded speed is 11 knots and the designed output of the machinery 1,000 shaft horsepower.

The two Diesel engines in this vessel are of a new type built by the North British Diesel Engine Works of Glasgow, the manufacturers who have recently devoted their attention to a double acting two-cycle Diesel engine of large power, which they are now building at their works. The small motors of the *Dumra,* however, are of the normal single acting four cycle construction, with six cylinders 15 inches diameter and 30 inches stroke, developing their power of about 700 indicated horsepower at 165 revolutions per minute with a fuel consumption of approximately 0.45 pound per brake horsepower hour.

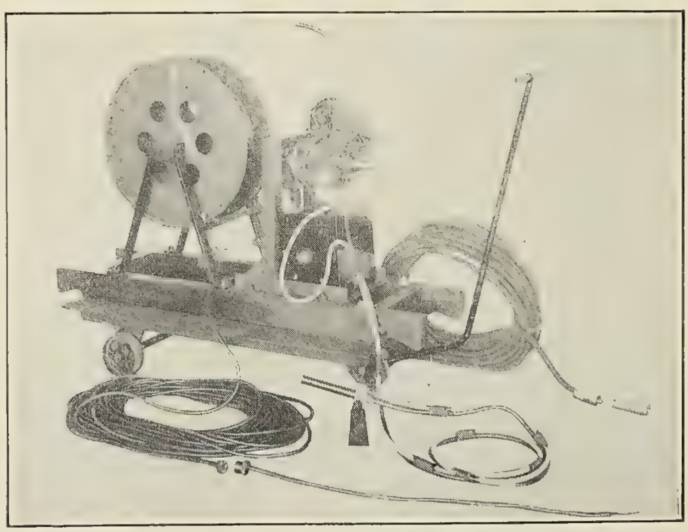
Although these engines are new in design there is little that is novel in their construction. The cylinders are carried on a heavy crank case supported on the bedplate, the cylinder covers and liners being separately cast. The usual four valves in the cylinder head are operated by cams on a camshaft, which is moved in the longitudinal direction when it is desired to go astern, thus bringing the astern cams below the valve operating levers. This movement for reversing is effected in the ordinary manner, through the agency of a compressed air servo motor controlled from the starting platform. There are two starting levers, one for the admission of compressed air, or fuel, to each set of three cylinders, this being a fairly common arrangement. The pistons are cooled with lubricating oil which is somewhat unusual but sea water is used for the cylinder jackets.

Except for the air compressors which are coupled direct to each propelling engine, most of the auxiliary plant is independently driven by electric motors, this including the circulating water and the lubricating oil pumps, etc. Two two-cylinder Diesel engines are installed in the engine room driving 50 kilowatt dynamos for the supply of the necessary power. These are in addition to the large vertical boiler providing steam for the operation of the steam winches.

Portable Semi-Automatic Arc Welding Set

In order to increase the applicability of its semi-automatic arc welding apparatus, and adapt it for use in any place where current for welding is available, the General Electric Company is now building a portable set. This comprises a complete semi-automatic equipment, with support for a wire reel, mounted on a small truck that can be pulled over the shop floor by hand, or lifted by a crane. The complete outfit weighs about 400 pounds.

The welding equipment consists of a semi-automatic lead, an automatic welding head, with control, and a standard for



The Set Can Be Used Wherever Welding Current Is Available

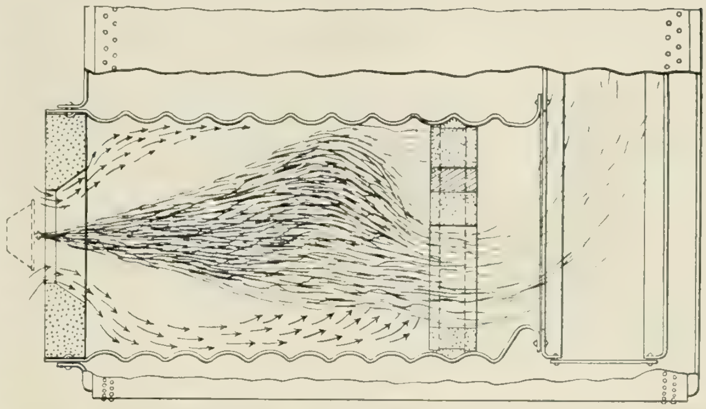
holding a reel of electrode wire. Power is supplied to the arc through a flexible cable with a plug for attaching it to the nearest welding circuit. The reel carrier is equipped with a brake and designed to take any size reel up to 2½ feet in diameter.

The portable outfit should be valuable in repairing parts of machines in place when these parts are too bulky, inconvenient, or otherwise impractical to move, and for doing routine welding of all sorts, such as filling holes in castings, welding seams in pipes or tanks, or other work of a similar nature. Besides the saving in time and trouble due to the portability of the outfit, its use will save both time and material in welding.

The electrode is fed continuously, the number of interruptions are reduced and less skill is required by the operator to make a good weld than is the case with ordinary hand welding. Material is saved by eliminating the waste ends which usually amount to at least ten percent of the total amount of electrode wire used.

Front Arches and Retarders Aid Combustion in Oil Burning Furnaces

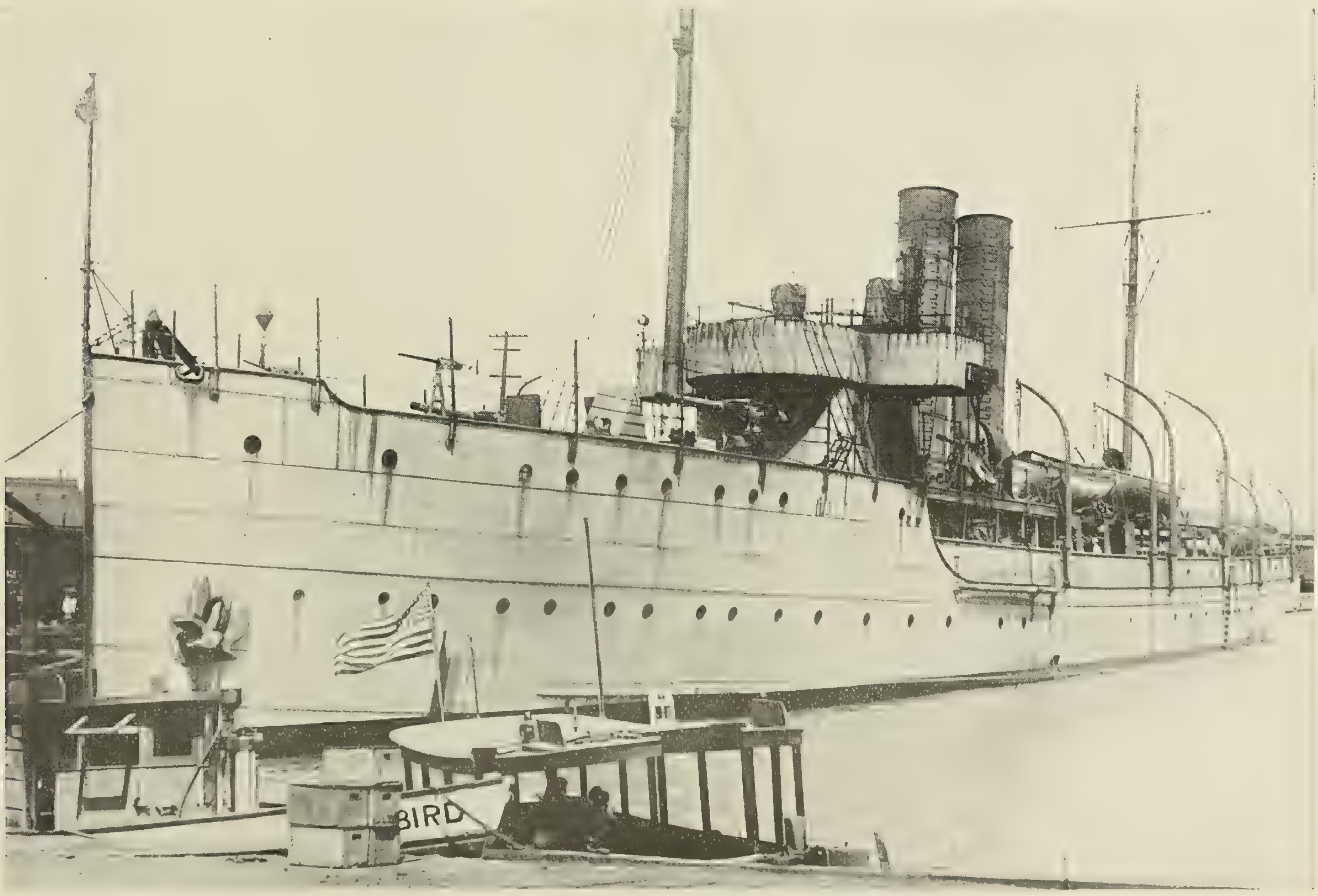
RETARDERS made of refractory brick have been developed by the T. G. Egan Refractory Engineering Company, Inc., New York, to aid combustion in furnaces in which oil is used. The accompanying diagram shows the arrangement of the retarder and also the front arch built by the same company installed in a Scotch marine boiler furnace. The retarder is built of blocks made to meet the actual furnace dimensions, tongued and grooved so that when placed in position they are firmly locked, making falling or warping impossible.



Front Arch and Retarder Installed in Furnace of Scotch Boiler

The retarder acts in a manner to retain the gases in the furnace and, because under the action of the flames it becomes incandescent, the gases are ignited causing complete combustion, increasing the carbon dioxide and greatly decreasing preventable fuel losses. It is stated by the company that savings of more than five tons of fuel per day have resulted from the use of the Egan retarder.

The front arch also installed in the furnace is made in sections each of which is provided with a locking device which insures the arch from falling. The arch is very easy to install and promotes the economy of boiler operation.



(Photograph from Keystone View Company, Inc., N. Y.)

Fitting Out Uncle Sam's Great Lakes Navy for Practice Cruises

On the Great Lakes the United States has only one war vessel, the U. S. S. Wilmette, the hull of which is that of the ill-fated Eastland, which capsized in the Chicago River on July 24, 1915. The photograph shows the Wilmette at the foot of Randolph street, Chicago, being fitted out for a series of two-week cruises on the Lakes, manned by naval militiamen and citizens who desire to make the voyages.

Marine Boiler Water Treatment

How to Prevent Scale and Corrosion — Water Testing Apparatus—Chemical Changes in a Boiler

By Commander J. B. Patton, U. S. N. (Retired)

SEA water and air are the enemies of the marine boiler. Corrosion and scale are the damages caused by these enemies. Sea water, alone will cause scale but it will not cause serious corrosion unless air is present. By "corrosion" is meant local pitting, which quickly destroys tubes and plates, and not common rust, which is of little importance. The latter is found in tanks and bilges, sometimes ½ inch thick and formed by a thin film of iron. The rust is light in density, and contains only a percentage of iron.

But as all water has some air in it, we cannot keep air entirely out of the boiler. The Weir feed water heater extracts most of the air, and ships with this heater have very little boiler corrosion, even when using salt water in the boilers. Experience proves that a small amount of sea water always gets into the boilers so we cannot expect to keep sea water and air entirely out of boilers. But we can win the battle, if we keep the salt down to a low quantity (say ⅛ by salinometer, or 150 grains of chlorine in a watertube boiler, and double that amount in a Scotch boiler), because a small amount of soda ash will neutralize that amount of salt water and prevent both corrosion and scale.

If the density gets higher, considerably more soda will be required and it should be put in, unless priming of the boilers forbids further addition of soda. If sufficient soda cannot be used, some scale may be formed but there will be no serious corrosion, if there is no air in the water. The amount of soda required was formerly guessed at but in modern practice the amount required is indicated by a daily test of the boiler water for alkalinity, as explained later.

Condensed Rules (Approved by Good Authorities)

(1) Buy a practical instrument for testing boiler water for alkali and chlorine (salt).

(2) Try to keep salt water out of the boilers. If the condenser leaks, stop and repair it, if possible.

(3) Try to keep air out of the boiler water.

(4) Test the water in the filter tank each watch for chlorine. If it contains under 40 grains, you can not taste the salt.

(5) Test the water in the boilers daily for alkali and chlorine, and maintain *an alkalinity of* 10 *to* 20 *grains per gallon* by putting daily additions of soda ash in the filter tank. As a starter, when filling a single-ended Scotch boiler of about 26 tons' capacity, put in 20 pounds of soda ash (other size boilers in proportion). This will start you off with an alkalinity of 20 grains to the gallon. Then a daily addition of one pound of soda ash to the filter tank for each boiler in use will be about right, unless the condenser leaks considerably (admitting salt water and neutralizing the soda). In this case, considerably more soda will be required to keep up the alkalinity. The alkali test will indicate whether the daily addition of soda ash is to be increased or diminished. There is an advantage in having the soda in the boiler before the salt gets in.

(6) It is best to have a ten-gallon water tank over the filter tank and to put the daily allowance of soda ash in it. A pipe and valve should be arranged so the mixture will drip into the filter tank all day long. This keeps the water alkaline and prevents corrosion around the discharge end of the internal feed pipe. But if you are unwilling to take this trouble, put it in once a day.

The Navy plan of removing air from feed water appears to be a good one; it is an adaptation of the Weir system to a high pressure heater. A quarter-inch pipe is run from the top of the feed heater or feed line and led back to the filter tank, with a valve kept slightly open. The air and also any oil present come back to the filter tank. The small amount of water coming back is not important. The high pressure tends to keep the air in solution but the high temperature tends to release it.

The internal feed pipe arrangement of the Babcock and Wilcox boiler is a good plan and might well be adapted to the Scotch boiler. This pipe discharges over the downcomer headers, but just under the water level, so that the air escapes to the steam space and does not follow the water to the bottom of the boiler.

Zincs

There is good reason to think that zincs are not needed when the water is kept alkaline. But the water is not always kept alkaline, and when the density is high, it may not be possible to keep it alkaline. For this reason, the zincs should be retained.

Action in the Boiler

In order to visualize what takes place in a boiler when salt water and soda ash are present, the following example is given:

Consider a single ended Scotch boiler, capacity 7,000 gallons or 26 tons, a very common size. As there are 7,000 grains in a pound, it happens that "pounds per boiler" and "grains per gallon" are the same thing for this size boiler. Suppose the boiler filled with fresh water, and 20 pounds of soda ash added. An alkali test should then show 20 grains per gallon. If one pound of soda be added daily, then after 30 days' steaming the boiler will have a total of 50 pounds of soda ash, or 50 grains per gallon. If the density has gone up to 120 grains of chlorine, or 1/10 by salinometer, then 40 pounds of the soda will have neutralized all the acid forming and scale forming elements in the boiler, and there will be 10 pounds of free soda left, or 10 *grains per gallon* of alkalinity by test.

As a matter of fact, the alkali test will probably show around 15 *grains per gallon,* on account of a very *important fact.* When an alkali test is made, the first ten grains may be a false alkalinity due to carbonates present, which does not mean the presence of free alkali. An actual test of water from the S. S. *Castletown* showed water of 3 grains alkalinity, and also containing 107 grains of magnesium chloride, showing the water to be highly corrosive and *potentially* acid. Since the days we stopped using animal or vegetable oils for internal lubrication, there is no such thing as boiler water giving an acid test or reaction. Boiler water containing a little salt may be *potentially* acid or corrosive, if it shows an alkali test of less than 5 or 10 grains. It may not be even "neutral" unless it shows this alkalinity. These facts are supported by good authorities in this country and in England and will be referred to later.

Condenser Leaks

If the condenser leaks sufficiently to supply the "make up" or "extra feed," the density in the Scotch boiler will go

up to ⅛ that of sea water, or 150 grains, in a day; in a watertube boiler, 6 to 8 hours. The filter tank water will have a density of about 40 grains per gallon, which cannot be detected by taste. This shows the importance of making frequent tests of filter tank water for chlorine.

Alkali

The standard alkali is soda ash (powder), or carbonate of soda. Sal soda (crystal) is the same thing, but only about half as strong, as it contains 60 percent water of crystallization. Some prefer it because it is easily handled. In a hot place it will melt in its own water.

Caustic soda, while chemically different, may be said to be, very roughly, about 1½ times as strong as soda ash. This is referred to later. Its use is recommended by some good authorities.

Lime will prevent corrosion and is about 1½ times as strong as soda ash but it is hard to dissolve and does not prevent scale but rather increases it, so its use is not recommended.

Boiler compounds of unknown formulæ are to be avoided. The Navy boiler compound is probably better than pure soda ash. Its formula is said to be as follows:

95 percent soda ash;
4 percent di-sodium phosphate (which is said to prevent priming);
1 percent organic matter (which is said to keep scale from settling on the heating surface. This is in line with the old idea of putting molasses, potatoes or sawdust in a boiler).

Shore Water

Shore water should be tested for chlorine (salt). Many shore waters contain considerable limestone and calcium sulphate, which are scale forming and are not indicated by the chlorine test. But if soda ash be used, they will be made harmless.

Blowing

Every pound of sea water that goes into a boiler (unless neutralized with soda) produces some hard scale. You blow out the salt but not the hard scale. Unless the feed water is fresh, it is best not to blow.

If the condenser leaks, it is best to stop and repair it. If this cannot be done, it is best not to blow unless the boilers prime, or the density gets up to 2/32, when salt is said to begin to deposit in a high pressure boiler. In any case, it is useless to blow unless the feed water is a great deal fresher than the water in the boiler.

Approximate Conditions in a Boiler Containing Some Sea Water. Quantities Shown Are Grains Per Gallon, or Pounds Per Boiler in a 26-Ton Boiler

1	2	3	4	5	6	7	8
Ounces	Density by Salinometer	Chlorine	Total solids	Salt	Hard scale	Corrosive matter	Total soda ash required to neutralize 6 and 7
5	1/32	1200	2100	1700	100	300	400
2½	½ of 1/32	600	1050	850	50	150	200
1¼	¼ of 1/32	300	525	425	25	75	100
⅝	⅛ of 1/32	150	262	212	12	37	50

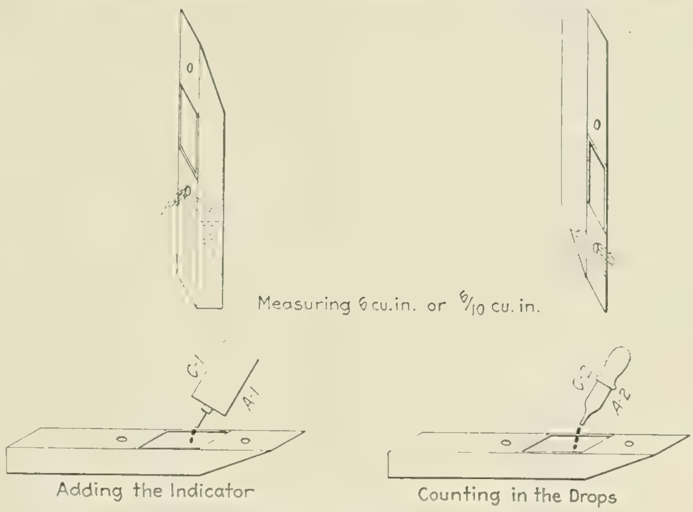
Water Testing Apparatus

There are several types of chemical outfits which may be purchased. All of them use the titration method. The alkali is neutralized by a measured quantity of acid. The chlorine is precipitated by a measured quantity of silver nitrate. Some of these outfits measure alkali only; some measure both alkali and chlorine. All of them are made of glassware, which is liable to be broken on board ship.

The Boiler Water Testtool (Invented by the writer).—This is a new instrument for testing water for both alkali and chlorine. It is sold by The Marine Works, Inc., 31 Coenties Slip, New York City. In this set, glassware has been practically eliminated. There are only five movable articles and these are made of metal or rubber. The measuring is automatic and there is no necessity for peering at faintly graduated glass tubes.

There is a white enameled ironware measuring and mixing tray in which the water sample is measured and tested, as explained below. The two indicators are in metal cans with nozzles. The acid and silver solution are measured by standardized hard rubber droppers, giving a drop of constant size.

To measure a sample of 6 cubic inches of water, the Testtool is dipped full of water and then held vertically, big end down, and the excess overflows and the water level falls even with a hole in the tray, thus retaining 6 cubic inches. The Testtool is then held horizontally, ready for the test.



Sketch Showing Operation of Testtool

This size sample is used for alkali test, or for testing fresh water for chlorine.

If held with the small end down, a sample of 6/10 cubic inch is measured. This size sample is for making chlorine test of salty water.

For the alkali test there is a can *A-1* (oil can type) containing Phenolphthalein indicator of which *several* drops are added to the water sample and which should turn red. Bottle *A-2* contains a standard acid and has a *standardized dropper*. The acid drops are counted into the tray, until the red color disappears; the number of drops used indicates the grains per gallon of soda ash.

For the chlorine test there are: Can *C-1*, containing potassium chromate indicator, and bottle *C-2* (with dropper), containing nitrate of silver solution. When testing *fresh* water, 6 cubic inches are used and *several* drops from *C-1* are added. Then sufficient drops from *C-2* are counted in till the water turns *red*. Each drop of nitrate of silver indicates one grain of chlorine. When testing *salty* water, 6/10 cubic inch of water is used and each drop of *C-2* indicates 10 grains of chlorine.

During this test there is nothing to break or even fall off the desk, for the Testtool is held in the left hand and the dropper in the right hand. The above has been found to give very accurate results.

Chemical Changes in a Boiler

The following is a brief statement of the changes which are said to take place in a high pressure boiler containing some sea water and soda ash:

Composition of sea water	Grains per gallon
Calcium carbonate	9
Calcium sulphate	114
Magnesium sulphate	134
Magnesium chloride	244
Sodium chloride	1706
	2207

1. The sodium chloride remains in solution, but may begin to deposit, if the density reaches two or three thirty-seconds.
2. The calcium sulphate forms hard scale but, if soda ash is present, calcium carbonate goes to the bottom as sludge and sodium sulphate remains in solution.
3. The magnesium sulphate is corrosive and may form scale, but the soda neutralizes it, precipitating the magnesium as sludge, sodium sulphate remaining in solution.
4. The magnesium chloride is corrosive but the soda neutralizes it, precipitating the magnesium as sludge, sodium chloride remaining in solution.

Air in Water

When corrosive salts are present, air and carbon dioxide are stimulating factors and increase corrosion immensely. There is reason to believe that air in fresh water is harmless. There are reports of corrosion of feed heaters at stationary plants by air in the water but probably some corrosive salts are present.

At the Naval Proving Ground, Indian Head, Maryland, there are watertube boilers with non-condensing engines, that have been in use many years without corrosion. The feed water comes from an artesian well by air lift pumps, and is strongly charged with air. It is pumped into the boiler cold. This water is practically pure having only a trace of silicon.

The power plant boilers at the Norfolk Navy Yard used 100 percent "make up" feed water and the water was well aerated, coming from a lake. There was no corrosion after years of service.

The tugboat *Leader* in New York harbor has a boiler forty-four years old, with the original tubes. The engine is non-condensing, and the feed water is New York city water, which contains air, of course, but no corrosive salts. The air did no harm here.

Alkali

Some years ago, the Scotch boilers of a new naval ship had to be retubed after two years' service. After a short time the new tubes began to pit. Within a year the tubes were giving out at the rate of one a week. No alkali had ever been used in the feed water. At this time the *storekeeper* was told to put two pounds of soda in the feed tank daily. That is absolutely all that was done; the result was that not another tube was lost and the ship ran many years with the boilers tight and sound.

S. S. Castletown.—A test of the boiler water on this ship showed 800 grains of chlorine, 107 grains of magnesium chloride and 3 grains of alkalinity. About 40 grains of soda per gallon had been used but it was not sufficient and the water was potentially acid although it gave an alkali test of three grains. In order to get this alkalinity up to ten grains, indicating an excess of free soda, it would be necessary to add sufficient soda to first neutralize all the corrosive salts present, or over 100 grains of soda ash per gallon.

The names can be given of many ships with good boiler tubes and furnaces thirty years old. On the other hand, many boilers are worn out in ten years or less. The writer was told recently, by a former superintendent of coastwise vessels, that he found the life of Scotch boilers to be about ten years.

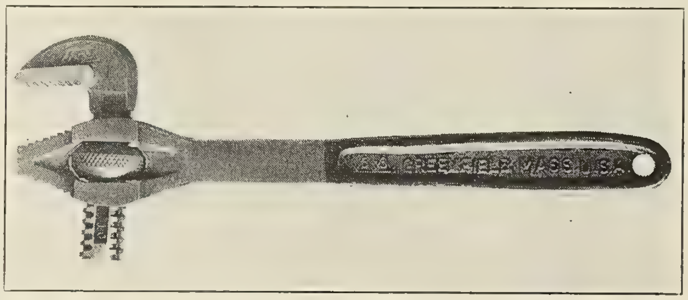
There must be a reason for this difference in durability, and there is no doubt that in most cases boiler corrosion and scale troubles are due to neglect of the simple and well-known rules referred to in this paper.

Reciprocal Inspection of Belgian Steam Vessels Authorized.—Under the provisions of an act of Congress approved March 17, 1906, the Secretary of Commerce, in Department Circular No. 289, dated July 15, 1922, authorized the reciprocal inspection of Belgian merchant passenger steam vessels, so that thereafter the merchant passenger steam vessels of Belgium sailing from ports in the United States and holding unexpired certificates of inspection issued by the duly constituted officers of Belgium shall be subject to no other inspection than such as necessary to satisfy the local inspectors that the condition of the vessel, her boilers, and life-saving equipments are as stated in the said current certificate of inspection. Copies of Circular No. 289 can be obtained on application to the Steamboat Inspection Service, Department of Commerce, Washington, D. C.

Pipe Wrench Designed for Difficult Corners

The Little Giant pipe wrench, embodying several interesting new features, has just been put on the market by the Greenfield Tap & Die Corporation, Greenfield, Mass. This wrench has the "end opening" feature which is familiar to users of machinists' wrenches. Its application to pipe turning can readily be seen by a glance at the illustration.

One important advantage of the Little Giant wrench is the ease with which it can handle pipes in corners, close to walls, and similar confined places. The person using it can set it straight on the pipe as he would a pair of pliers, instead of having to fit the jaws on from the side. There are only three parts, a handle and jaw in one piece, which is drop forged and heat treated; a movable jaw, likewise drop forged and heat treated; and a hardened steel nut. In spite of the absence of springs the wrench is said to take hold and release instantly at the option of the user.



Little Giant Pipe Wrench Embodying New Principle of Design

The new wrench has been designed for maximum strength, the 14 inch size having successfully withstood stresses in excess of 4,700 inch pounds without slipping or bending. Yet owing to the elimination of extra parts the wrench is relatively light in weight.

Another feature is the double set of teeth on the main jaw. The movable jaw can be engaged at the option of the operator with either of these sets of teeth with consequently lengthened life. On the large sizes, 14 inches and greater, two additional sets of teeth are provided, making four in all, and the movable jaw can be reversed to engage these additional sets of teeth, which are below the adjusting nut. This is very useful in connection with certain classes of work, besides tending to quadruple the life of the tool.

The Little Giant wrench is being manufactured in 8-, 10-, 14-, 18- and 24-inch sizes, of which the three smaller sizes are already on the market.

Navy League Designates October 27 as Navy Day.—At the suggestion of the Navy League of the United States, approved by the Navy Department, Friday, October 27, has been set apart as Navy Day on which an opportunity will be given for all the citizens of the country to honor this branch of the service which safeguards our peace and prosperity.

Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Valve Setting Problem

Q. (1167).—I have a twin screw reciprocating installation, link motion, cylinders 15½ by 26 by 44 inches; stroke, 26 inches; piston valves for high pressure and intermediate pressure inside admission and piston valve outside admission for low pressure cylinder. This particular design gives crossed rods and the approximate leads at full stroke are: High pressure, ½ inch bottom, ⅜ inch top; intermediate pressure and low pressure, 9/16 inch bottom and 7/16 inch top. High pressure valve is a plug valve and the other two stages are ring valves. The steam pressure at engine is 225 pounds.

I desire your advice in regard to the most suitable setting for these valves in order to bring about an economical distribution and consumption of steam and turn up 125 to 128 revolutions per minute at maximum cut-off, so as to be able to get approximately 135 to 140 turns at or about full stroke, as these engines are used in towboat service in the Federal Barge Line and it is often necessary to run out the expansion blocks and get all she has going through swift places.

Would a link motion having open rods be more suitable in your estimation than the present one with the cross rods? These engines were originally built to turn outboard as is the general practice with twin screw installation ships but when placed in this service were required to turn inboard when in ahead motion. To bring this about the crank shafts were merely transposed and to the best of my knowledge no other particular changes were made.

A. (1167).—Your question relative to the resetting of the valves for improved steam distribution is one which for its solution requires more of an investigation than is practicable for the editors of this department to undertake. At best the results which might be reached would be theoretical only and in all probability no better than the present valve setting. Inspection and comparison of your leads with engines of similar proportions and size would indicate the setting to be about the usual practice.

The most reliable and satisfactory results would be obtained by taking top and bottom indicator cards and computing the developed power from each cylinder under various conditions of cut-off, a cut and try process, until the cards show an approximately even distribution of power between the cylinders.

In an engine running in full gear the valve events are the same regardless as to whether the rods be open or crossed but when linked up the events are greatly changed. Lead increases when linking up with open rods but decreases to the point of negative lead with crossed rods.

Steam and exhaust openings decrease with crossed rods linked up, therefore the effect of the advantage of steam expansion is greatly decreased. The above would indicate that far better results would obtain from the use of open rods.

Relative Resistances of Models and Full Size Ships

Q. (1168).—Can you favor me with the facts which govern in the acknowledged standards by which the relative values of efficiency in testing model ships compare with the full size ship? For instance, a model shows 10 percent better results than the others, what will that represent in a full size ship?

A. (1168).—In deriving the resistance of the full size ship from that of the model as obtained from tests, Froude's law of comparison is assumed to apply in so far as resistances other than frictional are involved. This law is briefly as follows: If the linear dimensions of a ship are p times those of its model and the resistances of the latter at speeds V_1, V_2, etc., are R_1, R_2, etc., then at the corresponding speeds of the ship, $V_1 \sqrt{p}$, $V_2 \sqrt{p}$, etc., the resistances of the ship will be $R_1 p^3$, $R_2 p^3$, etc.

The total resistance, either ship or model, is made up of the frictional, the wave making, the eddy making, etc. The frictional resistance, as above noted, does not follow the law of comparison. It varies with $(\text{speed})^{1.825}$ and the frictional coefficient is different for long and short surfaces. The frictional resistance is generally estimated from a formula of the form $R_f = f\,S\,V^{1.825}$ in which S is the area of wetted surface in square feet, V is the speed in knots, and f is the coefficient experimentally determined for different lengths of wetted surface. This formula applies both to ship and model.

The total resistance of the model being known at a given model speed, the frictional resistance of the model is computed by the formula referred to above and deducted from the total model resistance. The remaining model resistance is expanded by Froude's law to obtain the residuary resistance of the ship at the corresponding ship speed. The frictional resistance of the ship is then computed similarly to that of the model. The total ship resistance is the sum of the residuary and the frictional ship resistances as just found.

A 10 percent difference in the resistances of two models may indicate a 10 percent difference in the resistances of the two ships represented but this does not necessarily follow. The relative values of the residuary and frictional model resistances for the same model as well as the differences in these resistances as between model and model affect the relationship between the ship resistances. It is a matter of calculation for the individual case.

Wood vs. Steel for Houseboat Construction

Q. (1169).—I am considering building a shallow draft houseboat and have already prepared plans which contemplate a hull 60 feet in length, 20 feet in breadth with a draft of 18 inches. I had originally intended to build the hull of wood but have thought that steel might be preferable because of its non-inflammable nature. Please discuss the relative values of wood and steel for boats of this type.

A. (1169).—Wood is almost always used in the construction of hulls whose lengths are less than 100 feet. This is perhaps due principally to the fact that there are many small boat building concerns scattered throughout the country which, while they are capable of building excellent wooden hulls, have neither the plant nor the personnel necessary to work steel. Therefore, one may build in wood and avoid meeting the heavy charges for overhead which the equipment necessary to work in steel involves. A steel hull may cost roughly from 30 to 40 percent more than a wood hull of the same dimensions.

It is generally possible to build a small boat of wood on a smaller hull weight than that of a similar steel hull of the same dimensions. This is because the members of the structure which are required to resist the bending and racking strains on the wooden boat as a whole are of ample size to withstand the local forces met in service while their

weight is less than that of the steel members designed for equivalent service in a steel hull.

In boats of small displacement it is necessary to use very thin plates and very light shapes in order to build a steel hull on the same weight as a wooden one. It results that the wooden hull is stronger locally than the steel hull. Because of this, the steel hull may, after a comparatively short period of service, show so many dents or dishes in the plating as to give it a very unsightly appearance even though entirely seaworthy.

Further, the insulating of a steel hull against heat and cold and the elimination of sweating present a somewhat more difficult problem than the ceiling of a wood hull.

In spite of the foregoing there are strong arguments in favor of the steel hull once one accepts its increased cost.

A properly designed steel hull is stronger against bending and racking forces than a wood hull. It is also stronger against longitudinal shearing forces.

It is tighter and freer from vermin than a wood hull.

It is not subject to water logging or soakage, with the increase in draft incidental thereto, and is, as you suggest, safer from damage by fire.

When the hull length approaches or exceeds 100 feet, the scantlings necessary in a steel boat to satisfactorily meet the bending and racking forces become sufficient so that minor bumps are easily withstood without local damage. Also at about this length the steel hull begins to have a real advantage over a wood hull from the weight standpoint.

International Shipping Conference Committee Reports

(*Continued from page* 648)

been slightly adjusted to give factors of subdivision which vary inversely as the length of the vessel when the origin of the curve is fixed at a length of 260 feet with unity factor.

(2) Whether the general form and position of the curve B_{11} as suggested in the Report, is generally acceptable, observing that it is now admitted curve B of the Convention, which is supposed to apply to a mixed type of vessel, is too stringent for vessels carrying mainly cargo and few passengers.

As regards the curve representing the lower standard of subdivision on the diagram, it should be remembered that whatever the number of passengers carried on a vessel, the appropriate factor of subdivision will always be decided by the Criterion of Service value obtained for that vessel.

(3) Whether the form of Criterion of Service suggested in the Report (11A) and the subsequently explanatory letter of December 14, 1921, is generally acceptable or whether, having regard to the subsequent note, a modification of this form of criterion is desirable.

(4) To discuss the limitations within which the curves B_1 and C_1 shall be applicable, having regard to the fact that below a certain length of vessel it is not economically possible to provide a one-compartment standard throughout the length, and that at and above certain higher limits of length all safety requirements seem to be reasonably met when any two adjacent compartments throughout the length can be flooded.

With regard to the Criterion of Service, it may be desirable to offer some further remarks.

It is extremely necessary that the Criterion of Service should be determinable in the early stages of the design. It can only, therefore, take account of the main factors involved.

It is suggested that the factors which may be expected to be known at this stage are: . Length, breadth, depth to bulkhead deck, draft, displacement volume, speed, horsepower, permanent passenger accommodtion below the bulkhead deck and number of passengers.

These factors should be combined in such a way that the numerical result obtained will closely approximate to the numerical values obtained from the actual ship when completed. They must also be combined in such a way that they will fairly differentiate between ship and ship in relation to the passenger-carrying function. It is to be observed that the passenger-carrying function must reflect the ratio which the space given to passengers bears to the total space available in the ship, subject to a correcting factor which shall to some extent take account of machinery space or horsepower or speed.

Express Liner Construction May Follow Passage of Shipping Bill

BELOW is published an extract from a letter of Chairman Lasker of the Shipping Board to Senator King of Utah which was written in refutation of remarks made by the senator following a printed resolution which he introduced in the Senate mentioning the financing by the Shipping Board of private ship construction in the event the shipping bill passed. Chairman Lasker said in part:

"Let me say that I never made any statement that the Shipping Board intended to advance private parties $25,000,000 for the construction of a ship, nor did I ever make any statement that anyone could, in good faith, construe to mean any such thing.

"In reply to inquiries from newspaper men as to whether the Shipping Board had any requests for loans for construction purposes, I stated that we had no formal requests but that in an informal way a new company that was being projected on paper (but for whose ultimate formation I could in no wise stand guarantor) had asked whether they could borrow as much as $25,000,000 providing they put $45,000,000 of their own money into building new ships, of which two would be 70,000-ton ships; in other words if, out of the Construction Loan Fund which the Shipping Board is authorized by law to create, the Shipping Board was prepared to lend $25,000,000 for which we would get as security $70,000,000 worth of ships.

"Of course, I could make no reply to the tentative question I explained to the persons making the informal inquiry that they would have to formally organize their company, pay in their money, submit the definite plans of the ships, and at such time the matter be taken up with the entire Shipping Board for consideration.

"I am happy to state to you, though, that I was much impressed by the stability of the people who made the tentative inquiry, and feel that they are serious in their desires to build ships that will be crown jewels in our merchant marine. Whether or not they will proceed as they stated, will depend on the fate of the pending bill to aid merchant shipping, but in the interim they are having plans drawn for their ships.

"The most encouraging moment in the history of America's merchant marine will be that moment when private parties actually subscribe $45,000,000 of their own money to put into $70,000,000 worth of ships and the government will receive full security for its advance."

NEW BOOKS

How to Start Marine Engines in a Cold Ship. By W. J. Woodcock. Size, 7¼ by 4¼ inches. Pages, 153. Diagrams, 13. New York, 1922; Spon and Chamberlain.

This is a valuable reference book, prepared by a sea-going engineer who holds licenses for operating ocean steamers and motor vessels of unlimited tonnage, giving full instructions for setting all the valves and operating single and cross-compound turbines, triple expansion engines, semi-Diesel engines and a full Diesel electric drive on ships. It is a thoroughly practical book and is written so that men in the engine and boiler rooms of modern sea-going vessels may become familiar with the equipment and with a systematic manner in which to handle it so that they can safely start a marine engine under any condition, or in a cold ship, without unnecessary loss of time and without any feeling of uncertainty as to the proper and safe procedure. Simplified diagrams show the location of all valves and piping in each case and the instructions for operating the machinery from the time the ship is cold until it has completed its voyage are as clear and concise as if given by the engineer on watch.

NEW BOOKS

Diesel Operators' Guide

Reviewed by A. B. Raymond*

The 20th Century Guide for Diesel Operators. By Julius Rosbloom and Orville R. Sawley. Size, 6¼ by 8⅞ inches. Pages, 637. Profusely illustrated. Seattle, Wash., 1922: Western Technical Book Company, Inc.

Those interested in the development of the marine Diesel engine have been looking for the publication of a book covering this subject in a comprehensive way. Messrs. Rosbloom and Sawley have undertaken to fill this gap and have compiled a mass of information and collected a large number of illustrations which make their book a very interesting and handy reference hand book.

The first three chapters cover such subjects as: Technical Terms, Theory and Miscellaneous Formulæ. Chapters 4, 5 and 6 cover the Principles of Diesel Operation, Liquid Substances and Questions and Answers on Diesel Operation. Chapters 7, 8 and 9 deal with Fuel Feed and Ignition, Principles of Construction, Auxiliary Machinery and Accessories.

Chapters 10, 11 and 12 treat of Detailed Description of Diesel Engines, Diesel Electric Propulsion and Low-Compression Oil Engines. Chapters 13, 14 and 15 cover Compressors, Pumps and Batteries.

The last chapter gives the United States Rules for Licensing of Engineers on Motorships, Lloyd's Rules and Extracts from Rules of American Bureau of Shipping.

Both the illustrations and text are well indexed.

Information in varying amounts is given regarding the following Diesel engines: Allis-Chalmers, Atlas-Imperial, Busch-Sulzer, Burmeister & Wain, Dow, Fulton, Junkers, Lombard, McIntosh & Seymour, Nelesco, Nobel, Nordberg, North British, Sperry, Still, Standard, Washington-Estep, Western, Werkspoor, Winton and Worthington.

The semi-Diesel and oil engines referred to are the Baltimore, Bolinder, Cummins, De La Vergne, Fairbanks-Morse, Gulowsen-Grei, Ingersoll-Rand, Kahlenberg, Mietz and Weiss, Petter, Prim, Steinbecker, Vickers and Wygodsky.

The authors have accomplished so much it may seem an imposition to suggest that no mention has been made of many makes which are on the market either here or abroad at the present time, such as: Ansaldo, Armstrong-Sulzer, Beardmore-Tosi, Camellaird-Fullagar, Doxford, Enterprise, Götaverken, Hawthorne-Werkspoor, Johnson, Kincaid, Krupp, Neptune, North Eastern, Pacific, Polar, Schneider, Stephen-Sulzer and Wallsend-Sulzer. Many of the above are built under license from well-known makes but the individual development is often of great interest.

The Diesel engineer also has many problems in connection with the auxiliaries and with the actual installations, such as taking care of the exhaust, foundations, critical speeds and vibration and added information upon these subjects will surely be welcomed.

Some of the formulæ given need a careful checking, as well as the index, and the English might be improved.

OBITUARY

Frank M. Hawkins who has been connected with the Crouse-Hinds Company, 30 Church Street, New York, for a period of twenty-five years, died recently. Mr. Hawkins had been actively engaged in the upbuilding of the business of this company and his loss will be keenly felt by all those associated with him.

George R. Edgcumbe, purchasing agent for the Clyde and Mallory Steamship Lines, New York, died recently at his home in Jersey City, N. J. He had served in various capacities with the Mallory Line for a period of forty-seven years, beginning his career with the company as a clerk in 1875. In his years of steamship service, Mr. Edgcumbe has won the greatest respect from friends and business associates alike.

PERSONAL MENTION

P. J. Farrington has resigned from the staff of the United States Navigation Company.

Elmer E. Froewiss, formerly with the Oriental Navigation Company, is now associated with the Kerr Steamship Company.

Charles Backman has organized the Backman Towing and Transportation Company, Inc., with offices at 15 Whitehall Street, New York.

D. V. Stratton has joined the organization of the Morse Dry Dock & Repair Company and is in charge of the New York office in the Whitehall Building.

Captain James Abernathy, formerly in command of the steamship *M. S. Dollar,* has been appointed port captain of the Robert Dollar Company at New York.

P. R. Crocker has resigned as traffic assistant at the New York office of the United States Shipping Board and on his return from a two months' trip in Europe will enter private business.

Harold Dollar, son of Robert Dollar, has left San Francisco for Shanghai to become Oriental manager of the Robert Dollar Company. He has recently been elected president of the American Chamber of Commerce at Shanghai.

Captain Francis H. Robinson, who has been connected with the Pacific Mail Steamship Company at San Francisco and the California Atlantic Steamship Company for many years, has joined the staff of the Munson Steamship Lines.

Norman B. Beecher, one of the admiralty counsels of the United States Shipping Board, will represent the Board at the meeting of the Comite Maritime at London, October 9-11, to discuss the proposed rules for the carriage of goods by sea.

Charles N. Crowell, naval architect and constructing engineer, has severed his association with William T. Donnelly, consulting engineer, New York, and returned to his home in Cambridge, Maryland, where he has established a temporary office.

G. H. Pouder, of the Export and Import Board of Trade of Baltimore, Md., will give lectures during the second semester of the 1922-1923 sessions, at the University of Maryland, on terminal management and expansion, which will be in conjunction with the university's commercial and economics course.

S. M. Phillips, of the Maintenance and Repair Department of the United States Shipping Board, will conduct the evening classes in naval architecture and marine engineering at the Brooklyn Polytechnic Institute, Brooklyn, N. Y., this year, providing the required number of students register before October 5. Mr. Phillips has conducted this class in past years with success. His experience in the yard, drafting room and naval architect's office give him exceptional qualifications for understanding what the student needs most to prepare him for a good job in the shipyard.

F. W. Leahy, one of the best known engineers in marine circles, has resigned from the management of the New York office of the Diamond Power Specialty Corporation to es-

* Naval architect, Tams & King, New York.

tablish his own business, the Leahy Engineering Company, with offices at 709 Second National Bank Building, Cincinnati, Ohio. The new company is specializing in power plant equipment as well as in several marine lines for river boats.

Rear Admiral D. W. Taylor, U. S. N. (retired), has been engaged as consulting expert in matters of ship design, construction and operating economy with the American Ship and Commerce Corporation. Admiral Taylor was chief constructor of the United States Navy and chief of the Bureau of Construction and Repair until July 1, 1922, at which time he retired. Since then he has been engaged in claims board work which will be completed in time to take up his duties with the American Ship and Commerce Corporation, October 1. His headquarters for the time being will be in Washington. Rear Admiral Taylor is the author of a number of books on naval subjects and is recognized as the highest international authority on steam power and ship propulsion. He is the first American ever honored by the award of the gold medal of the British Institution of Naval Architects for the best original paper on ship-shaped stream forms. He was retained by the British Government as an expert in the famous case growing out of the collision of the *Olympic* and the *Hawke* in 1911.

Rear Admiral D. W. Taylor, U. S. N. (Retired)

A. P. Allen, manager of sales and repairs of the Federal Shipbuilding Company, with sales offices at 26 Beaver street, New York, has resigned from the Federal organization and will enter a manufacturing and sales business of his own, the nature of which has not as yet been made known. Mr. Allen has been with the Federal Shipbuilding Company, a subsidiary of the United States Steel Corporation, for over two years and has during this time built up an efficient sales organization. Previous to his connection with the Federal shipyard, he was chief engineer of the Pacific coast plants of the Bethlehem Shipbuilding Corporation and during the last part of the war he was stationed in Washington as chief engineer and assistant manager of the Department of Construction and Repair of the United States Shipping Board.

A. P. Allen

Elmer Schlesinger has resigned as general counsel of the United States Shipping Board, the resignation taking effect September 1. Mr. Schlesinger joined the Board in June, 1921, with the idea of spending a few months in organizing the legal department of the Shipping Board and the Emergency Fleet Corporation. His services, not only in organizing the law department, but in protecting the interests of the Government, particularly in the matter of the large number of undisposed claims pending against the Shipping Board at the time he commenced his work in the department, have been very valuable. Mr. Schlesinger will return to private practice at once as a member of the firm of Stanchfield and Levy of New York.

Sanford H. E. Freund and Chauncey G. Parker have been appointed as general counsel of the United States Shipping Board and the Emergency Fleet Corporation following the resignation of Elmer Schlesinger. Mr. Freund will have general supervision and control of the Admiralty division, the contract, opinions, recoveries and special assignment division of the Emergency Fleet Corporation and other legal matters of the United States Shipping Board besides claims and litigation. Mr. Freund has been special counsel with the Emergency Fleet Corporation. during the past year. He graduated from Harvard University in 1901 and from the Harvard Law School in 1903. His career from that time until 1910 was mainly devoted to lecturing at Boston Univerity Law School, University of Chicago Law School and at the Harvard Law School, at the same time practising law in the city of Boston. From this time until 1918 he was general attorney for various railway companies; from then until 1919 he served as director of the United States Employment Service and also as a member of the facilities division of the war industries Board. In 1919 and 1920 he was assistant general counsel of the United States railway administration in charge of financial affairs. He resigned from this position and practised law in New York until he became special counsel of the Emergency Fleet Corporation.

© Harris & Ewing

S. H. E. Freund

Chauncey G. Parker, before assuming his duties with Sanford H. E. Freund as general counsel of the United States Shipping Board, was special counsel with the Emergency Fleet Corporation during the past year. He will have control and direction of litigated cases throughout the United States and also supervision of claims presented to the United States Shipping Board. He graduated from Harvard University in 1885 and Columbia University in 1887; from 1888 until 1915 he practiced law in New Jersey, taking a prominent part in several of the leading litigated cases in that state; in 1915 he served as receiver to the International Mercantile Marine Company and the Rock Island Company; in 1918 he was made special legal expert with the War Risk Insurance Bureau, Washington.

Chauncey G. Parker

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

Contract for Constructing Two Steamers to Cost $6,000,000 Awarded to Great Lakes Yard

THE contract for the construction of two passenger steamers to cost a total of approximately $6,000,000 has been awarded to the American Shipbuilding Corporation of Cleveland, O., by the Cleveland and Buffalo Transit Company, according to official announcement today.

The vessels will be of the paddle-wheel type driven by reciprocating engines and are to be 544 feet in length by 58 feet beam, which is a slight modification from the original intention, which is understood to have called for a vessel 600 feet long. The boats will have 600 cabins with accommodations for about 2,000 passengers each and were designed by Frank E. Kirby, naval architect at Cleveland and New York.

Two and a Half Million Dollar Contract for Four Diesel Electric Dredges Awarded to Sun Company

AT a price of $2,528,240, the Sun Shipbuilding Company, Chester, Pa., has been awarded the contract for the construction of four Diesel-electric, seagoing hopper dredges for the War Department, Washington, D. C. The Sun Company submitted the lowest tender out of a list of 16 bidders, including four navy yards.

The ships are to have an overall length of 268 feet 5 inches, each, length between perpendiculars 254 feet, beam molded 46 feet, depth 22 feet 6 inches, draft loaded 19 feet 6 inches and speed 11½ knots.

According to the specifications, each vessel will be equipped with three engines of the McIntosh Seymour type of 1,000 brake horsepower on the four-cycle system.

Steamer Caldas Awarded to Federal Yard for Overhaul

THE steamship *Caldas* of the Grace Line was awarded on September 13 to the Federal shipyard at Kearney, N. J., for general reconditioning of hull and engines including the alteration of bulkheads for fuel oil and miscellaneous repairs. The contract will cost about $35,000.

City of Norfolk to Spend $650,000 for Harbor Property

THE city of Norfolk, Va., will on October 1, 1922, make an extensive addition to its holdings of waterfront terminal property. The City Council has authorized the purchase of wharf, pier and warehouse property of the Old Dominion Steamship Company on Water street for $650,000. The purchase was recommended to the Council by City Manager Charles E. Ashburner, the property having a frontage of 650 feet on the water front.

Under the plan recommended by the city manager, the city is to issue $650,000 worth of 4½ percent fifty-year bonds.

Acceptance Trials of Submarine S-48 Prove Successful

UNITED STATES submarine *S*-48, built by the Lake Torpedo Boat Company, Bridgeport, Conn., successfully completed her official Government acceptance trials on Saturday, September 9. The trials were conducted under the supervision of a trial board consisting of Capt. J. G. Tawresy, Lieut. E. F. Zemke, Lieut. J. D. Jones, Lieut. Whitney and Messrs. Ford and Moore recorders.

The earlier trials consisted of surface and submerged firing of service torpedoes, one hour full speed submerged run, steering gear tests ahead and astern, quick reversing of engines, fuel economy tests, operating at various depths submerged and changing depths without change of trim, quick submergence from full power submerged under motors to a depth of 40 feet in 64 seconds. After the completion of these tests, a 52-hour endurance run was made, four hours of which was at full speed, 14½ knots, and the remainder of the time at 13¾ knots. This latter trial, considered the most severe test required to be carried out, was accomplished without a failure of any description. The engines, which are of the Busch-Sulzer type, and auxiliaries functioning perfectly.

The design and construction of this vessel has been stated frequently by naval officials to reflect great credit upon the builders and the boat is considered to be in advance of any submarine now in this or any other navy.

Charles Ward Engineering Works Awarded Contract for Construction of Sternwheel Lighthouse Tender

THE contract for the construction of the steel, stern wheel, steam-propelled lighthouse tender *Greenbrier* for the Lighthouse Service of the Department of Commerce, Washington, D. C., has been awarded to the Charles Ward Engineering Works, Charleston, W. Va., at a price of $128,000. The time of completion or delivery is 12 months. The bids submitted for the work were as follows:

Charles Ward Engineering Works, Charleston, W. Va.	$128,000
Howard Shipyard and Dock Company, Jeffersonville, Indiana	128,727
Johnson Iron Works, New Orleans, La.	159,800
Dubuque Boat and Boiler Works, Dubuque, Iowa	137,000
Charles Hegewald Company, New Albany, Ind.	169,000
Dravo Contracting Company, Pittsburgh, Pa.	169,800

The vessel will be for use in the upper Mississippi and Ohio rivers and will have a length overall of 164 feet 6 inches; length, molded, 140 feet; beam over guards, molded, 32 feet 6 inches; depth at side, molded, 5 feet; draft, light steaming condition, 2 feet 8 inches. The tender will have a complete steel hull braced by longitudinal and transverse bulkheads. The propelling machinery will consist of twin non-condensing steam engines direct connected to a radial stern wheel and supplied with steam by three horizontal underfired flue boilers. The vessel will be equipped with a hand steering gear and also a steam steering gear of the direct acting single cylinder type similar to the Crowley-Johnson or other approved make and sufficient capacity to operate the boat's three rudders.

An approved cast steel double barreled capstan, driven by a double cylinder steam engine in the forepeak, will also be supplied and there will be two metallic lifeboats about 15 feet long, fitted with air tanks, certified for 11 persons each, provided with solid round bar swinging davits; and a life raft of the catamaran type certified for not less than 8 persons. The boat will be heated throughout by steam.

The main engines will have cylinders 15 inches in diameter with a common stroke of 84 inches and all parts designed for a working pressure of 200 pounds.

Boilers

There will be 3 steam boilers of the Mississippi river type designed for a working pressure of 200 pounds per square inch. Each boiler will be about 26 feet long having two lap welded flues without joints.

The generating set will be mounted on a common sub-base of cast iron and be of a steam turbine direct driven type having a capacity of 10 kilowatts making approximately 3,600 revolutions per minute.

Orders for Three Additional Lake Freighters Expected

IT is reported on good authority that contracts will soon be placed on the Great Lakes for three additional freight steamships. Although definite details are not available at this time, the vessels will probably be about 600 feet long and have a deadweight carrying capacity of approximately 12,000 tons. The total cost of the three vessels will probably be close to $2,500,000 and it is expected that the orders will be placed before the end of this month.

Supply Vessel for Commercial Pacific Cable Co. to Be Built by Sun Shipbuilding Company

THE supply ship for the Commercial Pacific Cable Company which has been designed by Cox & Stevens, naval architects, 25 Broadway, New York City, has been awarded to the Sun Shipbuilding Company, Chester, Pa.

This vessel, which has a length of 169 feet 6 inches between perpendiculars, 30 feet beam and 15 feet depth, is equipped with triple expansion engines having cylinder diameters of 17 inches, 25 inches and 42 inches with a 30-inch stroke. Steam is to be generated in two Scotch boilers fitted with Dahl oil burners.

The cost of the vessel could not be learned but it is understood that it was close to $1,000,000. The contract calls for the completion of the ship in March, 1923.

Duluth Shipyard Is Awarded Contract for the Construction of Government Derrick Scow

THE Marine Iron & Shipbuilding Company, of Duluth, Minn., which submitted the lowest bid to the United States Engineer office at Duluth for the construction and delivery of a steel derrick scow, complete with machinery and equipment, has been awarded this contract. The scow is to have an over all length of 147 feet 4 inches, a beam molded of 40 feet and a capacity of 715 long tons.

The Marine Iron & Shipbuilding Company submitted bids on two propositions, as follows: (A) to construct the derrick scow complete, as specified, and to make provisional delivery afloat at the builders' yard—$97,844.22; and (B) to construct the derrick scow from contractor's own designs, weights and specifications, complete with steel hull, derrick, houses, living quarters, and stock machinery and equipment, in acordance with Government plans and specifications—$93.220.22.

Bids October 10 On Diesel Electric Tug for Mobile

BIDS for the construction of a 100-foot Diesel electric towboat for the United States Engineer Office, Mobile, Ala., will be received at Mobile until 11 A. M. October 10, 1922, according to latest announcements. The proposed vessel will have a length overall of 119 feet 3⅝ inches; length, molded, 100 feet; breadth, molded, 23 feet; depth, 5 feet; draft, loaded, 3 feet. The vessel and equipment will be built to the American Bureau of Shipping rules.

The vessel will be heated throughout by a hot water heating system and an Ideal-Arcola heater or equal of suitable size fitted for burning oil, if practicable, otherwise for coal, will be installed in the generator room. A motor-driven capstan will be installed, the capstan having a 9-inch barrel and will be about 32 inches high capable of pulling 6,000 pounds at 15 feet per minute. The motor will be of the inclosed ventilated type of at least 5 horsepower.

Machinery

The two Diesel engines will be a standard commercial product of American manufacture. At least two of the engines of the size offered shall have been under successful operation for at least one year on the date of opening bids and shall be under successful operation on that date, the bidders to furnish name of motors, location of engines, purpose for which used and length of time in actual operation.

Main Generating Sets

There shall be installed two multiple cylinder two- or 4-stroke cycle fuel Diesel engines, each capable of developing sufficient power to produce an output of at least 100 kilowatts. Each engine will be direct connected to an open type, direct current, continuous rating generator with a capacity of at least 90 kilowatts and with a 10 kilowatt exciter direct connected on main shaft.

Other Equipment

The main generators shall be shunt wound separate excited open type and of at least 90 kilowatts capacity at 125 volts D. C. The exciters shall be compound wound open type of at least 10 kilowatts capacity at 125 volts D. C.

The propelling motor shall be shunt wound separately excited open type and be at least 200 horsepower at 240 volts, 600 revolutions per minute.

A 7½ kilowatt 125-volt direct current generator direct connected to a gasolene engine on the same bedplate will be installed in the engine room. The engine shall be a four-stroke cycle 4 or 6 cylinder type with forced lubrication, cylinders and oil cooler water cooled, magneto ignition and complete with all necessary equipment.

Twenty-Six Additional Contracts Placed By Newport News Yard for Reconditioning Steamship Leviathan

TWENTY-SIX additional contracts for material to be used in the reconditioning of the steamship *Leviathan*, the world's greatest ship conversion job, have been placed by the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., according to latest official announcement. A wide variety of material is covered in the new contracts. The list of supplies and the manufacturer are as follows:

MATERIAL	MANUFACTURER
Door Switches for Wardrobes	Woodhouse Electric Co.
Wire for Floor Outlets	Hazzard Mfg. Co.
Asbestos Millboard for Radiators	Ehret Magnesia Co.
Radiator Valves for Heating System	McNab & Harlin Mfg. Co.
Slate Panel for Switchboard No. 2	Portland Monson Slate Co.
Vises for Carpenters and Plumber Shops	Southern Supply Company
Manila Rope for Running Rigging	Columbian Rope Co.
Carbon Brushes	Morganite Brush Co.
Brass Gasket Rings for Ozone Gen. Tubes	W. L. Woodside Co.
Plastic Fire Brick	Jointless Firebrick Co.
Fire Screen Bulkhead at Frame No. 155	Coburn Trolley Track Mfg. Co.
Injectors for Donkey Boiler	Hayden & Derby Mfg. Co.
Pax-Tite Leather Packing for Telemotor Pistons	Watson Stillman Co.
Armature Coils for Ventilation Fan Motor No. 173	Standard Electrical Mfg. Co.
Flexible Metallic Steam Hose	The American Metal Hose Co.
Recording Electric Pyrometers	The Bristol Company
Olomel Tester Putty	Olomel Mfg. Co.
Lacquer Screens for 1st class Social Hall	Robt. W. Chanler
Indicating Thermometers for F. O. Tanks	Schaefer & Budenberg Mfg. Co.
Sight Flow Indicators for Lubricating Oil System	S. F. Bowser & Co.
Leather Packing for Change Valves	The Watson Stillman Co.
Receptacles for Outside Deck Fixtures	Oceanic Electrical Supply Co.
Steam Traps for Sanitary System	Strong Carlisle & Hamond Co.
Copper Smith Work on Copper Coil Radiators	R. A. Burroughs & Co.
Thermometers for Forced Lubrication	Schaefer & Budenberg Mfg. Co.

P. & R. Railroad May Build New Docks in Cape May Harbor, N. J.

Following the start of the work of deepening the entrance to Cold Spring inlet, which leads into Cape May harbor, N. J., by the dredge *Absecom*, announcement is made that the Philadelphia and Reading railroad intends to build docks on the north side of the harbor.

Conversion of Four Steamers Awarded Todd Shipyards

THE contract for the conversion of four ships of the Southern Pacific Steamship Company from coal to oil burning vessels has been awarded to the Todd Shipyards Corporation, at a total cost said to be $336,800. The ships involved are the *El Siglo* and *El Cid*, which went to the Robins Yard, Brooklyn, N. Y., and the *El Dia* and *El Rio*, which have been placed at the Tietjen & Lang plant, Hoboken, N. J.

The bids submitted for the conversion and work incidental thereto are understood to have been as follows:

Tietjen & Lang	$336,800
W. & A. Fletcher	348,000
Robins D. D. & R. Co.	360,800
Morse D. D. & R. Co.	400,000

Shipbuilding In America Shows a Favorable Advance

There were under construction in American shipyards on September 1 a total of 25 seagoing steamers of 156,530 gross tons and 75 steel river and harbor boats of 37,395 gross tons, according to figures compiled by the American Bureau of Shipping. This shows an increase of 9 ships and 40,000 gross tons over July 1.

Since September 1, contracts for eight new ships are known to have been placed in American yards.

The work in progress on new steel tonnage on September 1 is shown in the following table:

All-Steel Vessels

Yard	No.	Gross.
American Shipbuilding Co.	4	33,100
Bethlehem Shipbuilding Co.—		
Sparrow's Point	3	15,900
Alameda Plant	3	28,500
Federal Shipbuilding Co.	3	16,000
Great Lakes Engineering Works	1	6,585
Manitowoc Shipbuilding Co.	1	4,900
Newport News Shipbuilding Co.	3	11,125
New York Shipbuilding Corp.	2	13,600
Pusey & Jones	2	5,240
Sun Shipbuilding Co.	2	13,004
Toledo Shipbuilding Co.	1	8,400
Total	25	156,530

River and Harbor Boats

River and harbor steel tonnage building and contracted for in the United States for private owners September 1:

Yard	No.	Gross.
American Bridge Co.	18	4,900
American Car & Foundry	3	1,500
Bethlehem Shipbuilding Corp.		
Baltimore D. D.	3	2,100
Alameda Plant	2	2,400
Consolidated Shipbuilding Corp.	2	500
Doullut & Williams	1	450
Dravo Contracting Co.	15	4,930
Eichlacy, John, Jr.	1	65
Federal Shipbuilding Co.	3	2,850
Johnson Iron Works	1	250
Kyle & Purdy	1	300
Los Angeles Shipbuilding and Drydock Co.	2	2,400
Marietta Manufacturing Co.	1	250
Midland Barge Co.	4	2,300
Pusey & Jones	1	300
Riter-Conley Manufacturing Co.	5	2,150
Staten Island Shipbuilding Co.	4	5,150
Tebo Yacht Basin	3	450
Ward Eng., Charles	2	2,000
William Cramp & Sons	3	2,100
Total	75	37,395

Midland Barge Company Has Low Bid of $59,850 for Two 4,000-Barrel Steel Oil Barges

THE bid of $59,850, for the construction and delivery of two 4,000-barrel steel oil barges for the Mississippi River, submitted by the Midland Barge Company, of Midland, Pa., has been recommended for approval by the U. S. Engineer Office, at New Orleans, La.

Tenders were submitted on September 15 with the following results:

Midland Barge Company	$59,850
Charles Ward Engineering Works	71,750
Penn Bridge Company	74,250
Dravo Contracting Company	79,550
Nashville Bridge Company	86,940
Tampa Shipbuilding and Engineering Company	96,000
Johnson Iron Works Dry Dock & Shipbuilding Company	85,275
American Bridge Company	104,500

The barges will have a length molded of 120 feet, beam molded 36 feet, depth molded 7 feet 6 inches.

Charles Ward Engineering Works Is Low Bidder for Construction of Two Steel Barges for Alabama

THE Charles Ward Engineering Works, of Charleston, West Virginia, with a price of $17,000, submitted the lowest tender for the construction of two steel barges for the United States District Engineer Office, at Florence, Ala., for which bids were opened on September 18. The proposals, which have been submitted to the Chief of Engineers at Washington for approval and award, were as follows:

Charles Ward Engineering Works	$17,000
Midland Barge Company	17,800
Nashville Bridge Company	19,240
Penn Bridge Company	19,340
Dravo Contracting Company	20,870
American Bridge Company	21,750
Howard Shipyards & Dock Company	22,773
Virginia Bridge & Iron Company	23,895
Charles Hegewald Company	24,490
Johnson Iron Works Dry Dock & Shipbuilding Company	26,900

Jahncke Dry Dock Company of New Orleans Busy with Newest Reconditioning Contract Awards

THE Jahncke Dry Dock Company, of New Orleans, La., has been awarded the contract to recondition the U. S. Engineer Department dredge *Galveston.* The work includes the general overhauling of all machinery and will cost about $50,000.

The Jahncke Company has also been awarded the contract to paint forty of the Mississippi Warrior steel barges, type C-500, this work to be done while the barges are making their usual trips up and down the Mississippi River. The company has converted a wooden barge of their own into a houseboat for store rooms and living quarters for the men on the above work. The contract involves about $75,000. The yard will also drydock the Sinclair Navigation Company's tanker *Tamesi* for a general overhauling.

$24,870 Bid By Nashville Bridge Co. for Dredge Pipe

BIDS for thirty 40-foot lengths of 20-inch discharge pipe, one 90 degree 20-inch elbow and four 3-foot lengths of 20-inch pipe for United States hydraulic pipe line dredge *Wahalak*, were opened by U. S. Engineer Office, at Mobile, Ala., on September 5. The Nashville Bridge Company, of Nashville, Tenn., with a figure of $24,870, submitted the lowest total price.

Sun Yard to Build Three Barges for Pennsylvania R. R.

IN addition to the contract announced recently, which was awarded by the Pennsylvania Railroad Company to Pusey & Jones Shipbuilding Company, Wilmington, Del., for the construction of a steel floating grain elevator, 100 feet long, a contract has been awarded by the same company to the Sun Shipbuilding Company, Chester, Pa., for the construction of three barges, each with a capacity of between 40,000 to 50,000 bushels.

The floating grain elevator will be capable of delivering from 12,000 to 15,000 bushels an hour and will be equipped with special machinery built by the Webster Manufacturing Company, of Chicago, Ill.

Million Dollar Port Improvement for Pearl Harbor

THE Bureau of Yards and Docks, Navy Department, Washington, D. C., has received bids under specification 4501 for clay walls and pier at the naval operating base, Pearl Harbor, H. T., as follows:

For the work complete, from the Hawaiian Dredging Company, 854 Kaumana street, Honolulu, (1) $1,000,000 (450 days); (5a) add $23,000, deduct $21,000; (7) add $5, deduct $3; (8) add $1.50, deduct $1.00; (10) 90 cents telegraphic modification; (1) deduct $188,257; (5) deduct $4,715 add $6,-396.

J. Lloyd, McKansas Building, Honolulu, (1) $1,105,736 (450 days); (2) $1,200,860 (450 days); (3) $785,000.

Marine Construction News of the Month

Ship Contracts—New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Additional Contract, Savannah, Ga.—Coast Guard cutter Yamacraw also went to Wilkinson Company's shops to undergo repairs.

Steam Pump Repaired, Buffalo, N. Y.—Steamer City of Buffalo was at Buffalo drydock to have one of her steam pumps repaired.

Lighter Repairs, Savannah, Ga.—A government derrick lighter went on Wilkinson marine railway to undergo repairs to the hull.

Schooner Drydocked, Portland, Ore.—The schooner Dauntless was lifted on the Port of Portland drydock for cleaning and painting the hull.

Dredge Drydocked, Chester, Pa.—The War Department's dredge Delaware was drydocked at the Sun Shipyard for miscellaneous repairs and painting.

Steamer Inspection, Long Island, N. Y.—Steamer Medon went to Hunter's Point drydock to be inspected by representatives of the Alaska Steamship Company.

Freighter to Be Repaired, San Francisco, Cal.—The Mary Hanlon went to San Francisco for repairs to her bow, stove in as a result of a collision with an oil tanker.

Conversion to Oil Burner, San Francisco, Cal.—A. R. Wood Lumber Company secured the Lake Bridge from the Shipping Board and re-converted her to burn oil.

Steamer at Southern Yard.—Steamer Cockaponset, assigned to Lykes Brothers for the London and Hull berth, moved from Nine-Mile Point to be drydocked for repairs.

Italian Steamer Drydocked, Chester, Pa.—The Italian steamer Teti was towed to the Sun Shipbuilding yards, where she was placed in drydock for miscellaneous repairs.

Boilers, Etc., Installed, San Francisco, Cal.—Steam schooner Brunswick went to the Eureka Boiler Works to have a new thirty-foot smoke stack and donkey boiler installed.

Propeller Blade for Steamer, Maryland.—The British Steamship North Pacific was docked at Sparrows Point for replacement of a broken propeller blade and to have her hull painted.

Conversion to Oil Burning System, Savannah, Ga.—United States dredges Morgan, Savannah and Gilmer went to Wilkinson Dry Dock Company to be converted to the White oil burning system.

Schooner Overhauled, Seaford, Del.—The Cumberland Queen, one of the largest four-masted schooners ever seen on the Nanticoke River, went on the ways at Seaford for complete overhauling.

Repairs to U. S. S. Eagle 34, San Francisco, Cal.—The U. S. S. Eagle 34 was towed into San Francisco bay with a broken planetary reduction gear. The vessel was taken to Mare Island for repairs.

West Coast Repairs.—At the Potero Plant of the Bethlehem Shipbuilding Corporation the company drydocked the Japanese freighter Ginyo Maru for temporary repairs. Price $25,000; time 12 days.

Baltimore Plant Contracts, Baltimore, Md.—The Baltimore Drydocks Plant of the Bethlehem Shipbuilding Corporation has received contracts for overhauling the Robin Hood and repairing the Nelson.

Vessel Repairs, San Francisco.—The South Coast went to San Francisco to be repaired, her mast and cargo booms missing and pilot house stove in as result of accident while unloading at Los Angeles.

New Ferry Ordered, Detroit, Mich.—Great Lakes Engineering Works were awarded contract to build a ferry steamer for the Detroit-Walkerville route. She will have a capacity for forty-five automobiles and 2,000 passengers.

Contract Award, Jeffersonville, Ind.—The Howard Shipyards is reported as having received a contract to construct a packet boat for the Eagle Packet Company, of St. Louis. The vessel will be 225 feet long and 50 feet wide.

Repairs, West Coast.—Steamer San Pedro, steam schooner Washington and lumber carrier Wahkeena went to the Bethlehem yards to be drydocked for cleaning. The dreadnaughts Oklahoma and Pennsylvania went to Hunter's Point.

Construction of Diesel-Electric Dredges, Chester, Pa.—Sun Shipbuilding Company was awarded the contract for the construction of four Diesel-electric, seagoing hopper dredges for the War Department, Washington, D. C. Price $2,528,240.

Contract Awarded, Cleveland, O.—The contract for the construction of two passenger steamers to cost a total of $6,000,000 was awarded to American Shipbuilding Corporation of Cleveland, O., by the Cleveland and Buffalo Transit Company.

Cleaning and Painting Contracts, California.—Southern Pacific ferryboat Santa Clara went on drydock to undergo cleaning and painting, and the Union Oil Company's carrier Oleum went on the Moore ways to also be cleaned and painted.

Sun Yard to Build Barges, Chester, Pa.—A contract was awarded to the Sun Shipbuilding Company by the Pennsylvania Railroad Company for the construction of three barges, each with a capacity of between 40,000 to 50,000 bushels.

Tug Completed, Milford, Del.—The Vineyard Shipbuilding Company completed a 60-foot wooden tug for the Munson Line, to be used in Cuban waters. The vessel will be propelled by a 100-horsepower Fairbanks-Morse surface ignition oil engine.

Bethlehem Plant Awarded Contract, Cal.—Bethlehem Shipbuilding Corporation, Union Plant, was awarded contract to install feed water heater, new feed pumps and new evaporators on the United States army transport President Grant. Price $22,000.

Contract for Freighter, Staten Island, N. Y.—The contract for the new steel freighter for the Catskill Evening Line was awarded to the Staten Island Shipbuilding Company. Price $101,260. Contract covered construction of hull, machinery foundations only.

Bethlehem Yard to Build Float, Baltimore, Md.—The sparrows Point Plant of the Bethlehem Shipbuilding Corporation was awarded contract for the construction of a car float for the Baltimore & Ohio Railroad, 283 feet long, 37 feet beam, and 10 feet 6 inches depth.

Canadian Commander Repairs.—The steamship Canadian Commander, which recently ran ashore at Plate Point, Little Miquelon, is at the Canadian Tankers' yard, Montreal, undergoing repairs which will cost close to $100,000. The ship sustained considerable hull damage.

Repairs, Pittsburgh, Pa.—Landing boat of Second Pool Coal Company, Allegheny River, was placed on ways of the Pittsburgh Dock Company for general overhauling. Two barges of the Equitable Towing and Transportation Company also went on the ways to be repaired.

Installation of Watertube Boilers, New York.—The New England Steamship Company, New York, placed an order with Babcock & Wilcox Company, 85 Liberty street, New York, for eight marine watertube boilers, aggregating 9,000-horsepower, for installation on Fall River liner Priscilla.

Special Type Ship Ordered, London, England.—The firm of Workman, Clark and Company, Ltd., is reported as having secured an order for the construction of a coal carrier of 10,000 deadweight tons of special type for an American firm. The new ship will be about 425 feet in length.

Steamboats Repairing, Great Lakes Section.—Steamer Samuel Mitchell went to Ecorse yards to have her engine rebuilt. Steamer Douglas Houghton was placed in drydock at Lorain for repairs to her wheel and rudder, and steamer Robert Fulton went to Cleveland for minor repairs, as a result of a collision.

Tanker Alameda Reconditioned, Philadelphia, Pa.—The former United States Navy tanker Alameda, which was beached near Cape Fear last winter, is said to have been purchased by the William Cramp Ship and Engine Building Company, which is planning to recondition her and offer her at a competitive sale.

Repair Work, Mobile, Ala.—Alabama Dry Dock & Shipbuilding Company made following repairs to steamship Federal: removed entire turbine, gears, etc., and replaced same; installed new lubricating system; made and installed with necessary piping to accommodate the oil system, and changed from forced feed to sight gravity system.

Construction of Motor Passenger Launch, Stamford, Conn.—The Luders Marine Company was awarded a contract for constructing fast motor passenger launch, 40 feet long, 9 feet beam, 5 feet 6 inches depth, and 3 feet draft, by the Standard Oil Company of New Jersey for the account of the Standard Oil Company of Venezuela.

Shipyard Activities, Mobile, Ala.—Mexican tug El Aguila went to plant of the Alabama Dry Dock and Shipbuilding Company for repairs. Considerable work was done on tug's plates, tailshaft, etc. Other vessels repaired at the same yard included the barges Coastwise, Oriole and Choctaw, the tug Hukey and the Coast Guard cutter Arrow.

Sub-Chasers Converted, New York.—Seabury & de Zafra, Inc., naval architects, 150 Nassau street, were awarded following contracts: Completion of engine trials of sub-chaser; prepare plans for conversion of another for yacht service, and a third for commercial use of fur interests; fit out E. S. Pawnee for wrecking and lighterage operations along Atlantic Coast.

Ferryboat for San Francisco, Cal.—Aven J. Hanford, president and general manager of the Golden Gate Ferry Company, has announced that a second steamer to engage in the service now maintained by the ferryboat Golden Gate between San Francisco and Sausalito is under construction. The vessel is to be named the Golden West and will be of the same type as the Golden Gate.

Installation of Boilers, Pittsburgh, Pa.—The Pearson Manufacturing Company received the contract to install a battery of three boilers on steamer National of the J. K. Davison & Brothers. They will be of the two-flue type, 38 inches wide and 26 feet long. The company also completed repairs to the boilers and machinery of the steamer Hibernia, owned by the Equitable Towing and Transportation Company.

Construction of Two Passenger Steamers, Wilmington, Del.—Contract for construction of two day-passenger steamers, driven by reciprocating engines, at total cost of $529,000, was awarded by the Wilson Line, of Wilmington and Philadelphia, to the Pusey and Jones Company of Wilmington, Del. Vessels designed by George G. Sharp Company, naval architects and consulting engineers, 30 Church street, New York City.

Repairs to Six Ships of San Francisco Corporation.—Six ships of the Pacific Freighters' Corporation were awarded to the following companies: Pequot Casco and Arcadia, Robins Dry Dock & Repair Company, Brooklyn, N. Y.; the Pawnee, Sun Shipbuilding Company, Chester, Pa.; the Isonomia and Ida, Maryland Dry Docks, Baltimore, Md. Repairs included drydocking, scraping, painting, boiler work and general overhauling subject to inspection.

Spanish Naval Orders.—According to accounts from London, a contract has been arranged between the Spanish government and the Sociedad Espanola de Construccion Naval covering a period of three and a half years and providing for the construction of two large and powerful cruisers, together with destroyers, gunboats and submarines. It was stated that the cruisers will be of the Raleigh type, heavily armored, with powerful guns and that the armament will be supplied by Messrs. Vickers, Limited, and the armor plates by Messrs. William Beardmore and Company, Ltd.

SHIPYARDS AND DRY DOCKS

Establish Wood Yard, New Orleans, La.—A shipyard, for building and repairing small wooden boats, is to be established on the Jefferson Terrace Subdivision above the Jefferson Race Track by Paul and Fred Zibilich.

Shipyards to Be Moved, West Coast.—Al Larsen's Boatbuilding Plant, the Wilmington Boat Works and the M. and M. Machine Shop will be forced to move from Mormon Island, near Los Angeles, Cal., because of contemplated improvements by the city of Los Angeles.

10,000-Ton Drydock Reaches Mobile.—The last of four sections of the 10,000-ton drydock being moved to Mobile from New York by the Todd Shipyards Corporation has arrived at its destination. The 1,700-mile journey was made in sixty-eight days, in spite of unfavorable weather and adverse winds. All four sections arrived in perfect condition and will be reassembled immediately for operation late this month.

Navy Yard to Close, Charleston, S. C.—November 1 will mark the date of the closing of the Charleston Navy Yard. It had been expected that the yard would be closed about September 1, orders having been issued that it should be closed as soon as possible, but owing to the unemployment at Charleston, Acting Secretary Roosevelt decided to defer the closing and provide for the gradual discharge of the employees.

New Section Added to Drydock, New Orleans, La.—A new 5,000-ton section is being added to the present 2,000-ton drydock of the Johnson Iron Works Dry Docks and Shipbuilding Company. This will increase the efficiency of the plant and at the same time enable it to accommodate the largest vessels that enter the port of New Orleans. The section, constructed in New York, represents an outlay of $100,000, and was towed to New Orleans from the building point. Nearly 500,000 feet of lumber were used in the construction of the section. The new dock will accommodate vessels drawing 21 feet of water and will be operated by electricity. About twenty vessels a month are handled by the concern.

PORT IMPROVEMENTS

Pier Extension, San Francisco, Calif.—State Board of Harbor Commissioners, Calif., awarded contract to Clinton Construction Company for extending Pier 22. Price $76,365.

Pier Contract, Philadelphia, Pa.—Simpson, Brown & Company, 90 West street, New York, were awarded contract by F. H. Caven, Director of Public Works, Philadelphia, for one story pier building, Allegheny Avenue and Delaware River and also for improving and enlarging Allegheny Wharf 127. Engineer's estimate, $100,000.

Pier Extension, San Francisco, Cal.—The Clinton Construction Company was awarded the contract for extending Pier 44 to meet the requirements of the China Mail Steamship Company, to whom that section of the waterfront docking space had been awarded, by the State Board of Harbor Commissioners. The Clinton Company, with a price of $57,425, was the lowest bidder of five, the highest being Hannah Brothers, who asked $62,350 for the work.

Contract Let, Orange, Tex.—Contract for construction of additional units to the municipal wharves was awarded by wharf and dock commission to Houston Construction Company. Improvements are to cost approximately $221,000. Contract provides for the extension of the wharf apron for a distance of 1,008 feet; construction of two roofed sheds, dimensions of each being 400 by 90 feet; the extension of the municipal railway tracks behind the new warehouses for a distance of about 1,000 feet and construction of 100 feet of open platform between the two houses. A brick fire wall will separate the two sheds. Contract provides that work shall begin at once and shall be completed within 150 days from date of beginning. Wharf and dock construction contract will be carried out under a bond issue for $250,000, suspended for 1921 and put into effect in 1922.

GOVERNMENT WORK

Riprapping Dike, Mare Island, Cal.—Specification 4,700. Bureau of Yards and Docks, Navy Department, Washington, D. C., plans riprapping dike.

Riprap Protection, Hampton Roads, Va.—Specification 4,699. Bureau of Yards and Docks, Navy Department, Washington, D. C., plans riprap protection for north breakwater at Hampton Roads.

Steel Hull, Montgomery, Ala.—Johnson Iron Works Dry Dock & Shipbuilding Corporation, Morgan and Seguin streets, has received a contract from U. S. Engineer, Montgomery, for a steel hull for dipper dredge Upatoi. Price $25,850.

FOREIGN ACTIVITIES

Larache Harbor Developments, Morocco.—A sum of 3,461,000 pesetas for Larache Harbor Works is included in a supplementary credit of about sixty million pesetas for public works in the Spanish zone of Morocco, laid before the Spanish Parliament by the Minister of Finance.

Floating Dock, Trieste.—A floating dock of reinforced concrete construction, 64.15 metres long and 21 metres wide, has been recently acquired by the Navigation Company of Trieste. The dock has electrically driven centrifugal pumps installed and has a lifting capacity of 2,000 tons. It has been built for the repair of vessels on the Adriatic fleet of the company.

Launching of Steamer, Scotland.—The steamer Spero was launched by the Dundee Shipping Company. The company built the vessel for Ellerman Wilson Line of Hull. The dimensions of the Spero are as follows: Length, 257 feet; breadth, 37 feet; and depth molded, 19 feet. The new ship, which will be engaged in the produce trade between Denmark and Great Britain, will be fitted with refrigerating machinery.

Trials of Passenger and Mail Steamer, Scotland.—The Scott's Shipbuilding and Engineering Company, Greenock, completed and handed over the twin-screw passenger and mail steamer Aconcagua, built for the Compania Sud Americana de Vapores, of Valparaiso. The vessel is one of two sister ships, the second to be launched later. The Aconcagua ran trials on the Firth of Clyde and attained a mean speed of 17½ knots—half a knot over that stipulated in the contract, all machinery working with great smoothness. The two vessels are each 438 feet in length over all, 56 feet molded breadth, 33 feet depth molded to bulkhead deck, of 7,000 tons gross, and of 8,500 shaft horsepower.

Maiden Voyage of Canadian Pacific Steamer.—The new steamship Montclare, the third new "M" steamship of the Canadian Pacific Line, completed her maiden voyage to Montreal successfully. She was launched on December 17, 1921, at the yards of John Brown & Company, at Clydebank, Scotland. The Montclare, built to the requirements of the highest class of Lloyd's Register under special survey, is classed "100A1," and is a geared-turbine steel steamship with two funnels. The vessel is 566 feet long, 70 feet in breadth, 51 feet depth; over 16,418 tons, with regular speed of 17 knots. Accommodation is provided for not less than 620 cabin passengers, and 1,550 third class passengers. She burns oil for fuel.

Oil Tank Steamer Launched, Newcastle-on-Tyne.—Swan, Hunter & Wigham Richardson, Ltd., from their Neptune Shipyard, launched a large oil tank steamer, being built to the order of the British Tanker Company, Ltd. The steamer, which is designed to carry over 10,000 tons of oil, is about 455 feet in length by 57 feet beam, and is being constructed to attain the highest class in Lloyd's Register. The propelling machinery will consist of a set of turbines of the Metropolitan-Vickers Rateau type, with double reduction gearing of the three-box, floating frame type, steam being supplied by three large boilers fitted with Howden's system of forced draft, and burning oil fuel on the Wallsend-Howden system. The principal engine-room auxiliaries will be electrically driven. The vessel was named the British Gunner.

Oil Tanker Launched, Scotland.—Messrs. William Beardmore & Company, Ltd., launched from the East Yard of their Naval Construction Works, Dalmuir, the oil tanker British Merchant, to the order of the British Tanker Company, Ltd. The vessel is built of steel under special survey to class 100A1 at Lloyd's and is framed throughout on the Transverse System. She has a length between perpendiculars of 440 feet, breadth 57 feet, depth molded 33 feet 11 inches, 26 feet 6 inches draft, and is of 10,000 tons deadweight with a speed of 11½ knots. Her oil carrying capacity is about 9,500 tons of light oil in twenty compartments carried up to the main deck, with expansion trunks to the upper deck and side tanks between the main and upper decks. Steering gear is electrically driven, all other auxiliary machinery being steam-driven. Propelling machinery consists of one set of compound turbines of Metropolitan-Vickers type driving double-reduction gearing, and steam is supplied by three single-ended cylindrical boilers.

Chilean Ports to Be Improved.—A German engineering firm has been awarded a contract for erecting a modern pier, etc., at Valparaiso. All material for the pier, which will be constructed of cement and steel, are also to be obtained from Germany. The contract calls for an irregular triangle extending into the sea, its base formed by the shore line, and its sides by two massive stone walls, which, starting at the base, will converge in the waters of the harbor. This triangle will cover an area of 17,280 square metres, while the wall will have a length of 199 metres on the west side and 135 metres on the north side of the triangle. Extending toward the west, in continuation of the north sea-wall, the pier proper will be constructed of re-inforced concrete. The length will be 162 metres, and the width eighteen metres at the starting point, diminishing to 16.8 metres at the extreme end. Loading and unloading equipment is not included in the contract, the placing of this contract being in the hands of the Railway Department, Santiago-de-Chile, which has now complete control of the Arica-La Paz Railway. The equipment will consist of one 25-ton, two 3-ton and two 5-ton electric cranes, and two special chutes for loading ore into lighters will be required. The construction price of the pier and attendant works is 3,050,000 pesos (paper), plus 200,000 pesos (gold), of 18d. The work is expected to occupy at least two years. Besides improvements at Valparaiso, complementary works at the port of Antofagasta and repair works at the ports of Constitucion, Iquique, Talcahuano, Lebu, Puerto, Saavedra and Valdivia will be carried out.

Danzig's Shipyards Internationalized.—Danzig's shipyards and railway shops, in the past operated by the City Government, are to be "internationalized." The Danziger Werft (Danzig Shipbuilding Yards) and the railway shops are employing about 5,000 men at the present time on repair work largely, but the building of five steamers for Chile has begun. The repair shops were the property of the German Government before Danzig became a free city. The committee appointed some months ago by the Senate of the Free City of Danzig to formulate plans for operation of these properties has just submitted its report to the Senate. The adoption of the plan recommended by the committee is not absolutely certain, although as about eight months have been spent in perfecting the project it seems highly probable that the scheme will be carried through. According to the plan, both the shipyards and the railway shops are to be "internationalized," each being converted into a stock company conducted independently of the other, although having community of interest. The capital of each company is to be 20,000,000 German paper marks; the stock to be taken by four groups—the first, the French company, Societe des Betignolles of Paris; the second, the English company, Cravens & Company, Ltd., of Sheffield; the third, a group of eight Warsaw banks, and the fourth, not yet formed, a group of Danzig banks and capitalists. Danzig and Polish interests are each to have 20 per cent of the capital stock in each of the companies; in the shipyards company the English group is to have 60 per cent, and the French company is to have 60 per cent of the railway shops' stock. The title to the property, grounds, buildings and equipment is to rest in common with Danzig and Poland.

Todd Yard Holds Successful Tests of New Equipment on Fireboat

The official tests of the New York City fireboat *James Duane*, held at the Clinton plant of the Todd Shipyards Corporation, proved highly successful and indicated that she will be the most efficient fire fighter afloat. New turbines and pumps were inspected at the plant by the Fire Commissioner, Thomas Drennan, and other officials from the Fire Department and the National Board of Underwriters.

The new pumps are Lea-Courtney centrifugal, single stage double suction, driven by Westinghouse steam turbines. Against a pressure of 150 pounds, the pumps discharged 9,800 gallons of water per minute; against a pressure of 175 pounds, the pumps delivered 7,900 gallons per minute; against a pressure of 300 pounds, the pumps delivered 4,850 gallons of water per minute.

STEAMSHIP INTERESTS

The Rutland Railroad, which disposed of its lake steamers when the provisions of the Panama Canal law went into effect, has announced a resumption of rail and lake freight transportation between New England and the West via Ogdensburg, N. Y.

Blakely Smith & Company, of Houston, Texas, local agent for the Nervion Line, has announced the extension of its service to include direct sailings from Houston to Genoa, Italy. The Houston-Barcelona service of the line will be maintained as usual. The first ship of the new service is due in Houston about October 1. Sailings at monthly intervals will be maintained. Although all cargo offered will be accepted, it is thought that a large portion of the shipments will consist of cotton. Large shipments of cotton are expected to move through Houston to Genoa this season.

Saturday, August 19, was the second anniversary of the first sailing of the United American Line from New York. Since August 18, 1920, the United American Lines has had a total of 436 sailings of American flag ships from United States North American ports.

The steamer *Santa Ana* will be added to the fleet of the Grace Line operating between New York and ports of the West Coast. Sailings from September 7 will be fortnightly instead of every three weeks as heretofore. The combination cargo and passenger vessels now operated in the service by the Grace Lines are the *Santa Louisa, Santa Elisa* and the *Santa Teresa*. Each has accommodations for about 100 passengers. Ports of call in Chile and Peru are Callao, Mollendo, Arica, Iquique, Antafagasta, Valparaiso and Tulcuano.

According to announcement by Walker-Ross, Inc., the Tatsuuma Kisen Kaisha has inaugurated a transpacific service between the Pacific Northwest and the Orient. The first steamship in this service is the *Somedono Maru*, which will go on berth in Puget Sound during the last half of September, loading for Japanese ports. A monthly service will be maintained from Puget Sound and British Columbia ports, and also from Columbia River and Grays Harbor if inducements are sufficient.

The Danish East Asiatic Company is to re-establish offices in Seattle and will in the future maintain regular service out of that port for the first time since the beginning of the World War in 1914.

TRADE PUBLICATIONS

Galvanizing Equipment.—Apparatus of the moving cathode type for galvanizing and plating has been developed by the U. S. Galvanizing and Plating Equipment Company, 32 Stockton street, Brooklyn, N. Y. The arrangement of the apparatus, its value in a variety of plating work, together with numerous illustrations and diagrams, make up the pamphlet. Contained in the same covers is also a pamphlet on U. S. automatic cleaning, pickling, acid dip, neutralizing, rinsing, drying and allied equipment.

Stokers.—Bulletin 294 has been issued by the B. F. Sturtevant Company of Boston, Mass., describing the Sturtevant underfeed stokers, which include a centrally located horizontal retort, extending longitudinally with the furnace and provided at its upper edge with tuyeres through which air is introduced to the fuel as it rises into the fire. A complete explanation of the operation is given with illustrations.

Heavy Duty Diesel Engines.—Atlas Imperial mechanical injection fuel Diesel engines are described in a catalogue issued by the Atlas Imperial Engine Company, Inc., Oakland, Cal. An explanation of the mechanical problems met in Diesel engine design with illustrations and characteristic details of engines in small and large power units are given together with numerous views showing application of these engines in stationary and marine practice.

Cast Iron Storage Tank.—The Conveyors Corporation of America, Chicago, has issued a new booklet describing its American cast-iron sectional storage tank which is designed for holding loose, bulky, dry materials for storage or transfer. The booklet is illustrated with engravings showing the tanks in use at a number of well-known plants. Diagrams give details of construction and a comprehensive table of weights and measures is included.

Welding Repairs.—Methods of utilizing welding in repair work in England are outlined in a bulletin recently sent out by Barimar, Ltd., Oxford street, London, England. Details for engine and general machine repairs are explained with photographs of the work in process and in the finished state.

Seamless Steel Tubes.—The third of a series of four bulletins describing the manufacturing processes carried on by the Standard Seamless Tube Company, Pittsburgh, Pa., has recently been sent out. The subject dealt with in this case is the cold draw department.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—S. M. Robinson.
U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City.
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
President—H. H. Raymond.
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

Marine Engineering and Shipping Age

Volume XXVII — November, 1922 — Number 11

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
L. S. BLODGETT, Associate Editor — W. Z. GARDNER, News Editor

Contributing Editors
Rear Admiral C. W. Dyson, U. S. N. — William T. Donnelly
Commander S. M. Robinson, U. S. N. — H. McL. Harding
William Gatewood — James L. Bates
Captain C. A. McAllister, U.S.C.G. (Retired)

WE GUARANTEE that of this issue, 6,650 copies were printed; that of these copies 3,768 were mailed to regular paid subscribers, 209 were provided for counter and news company sales, 199 were mailed to advertisers, 85 were mailed to employees and correspondents and 2,389 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 61,400—an average of 5,582 copies a month.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

The Showdown

AT this writing it is believed that the President will call a special session of Congress in November to take up the proposed shipping legislation. The failure of the United States to adopt a constructive shipping policy has prevented private capital from investing in marine securities. It has caused us to tie up so many vessels that over one-half of the entire idle tonnage of the world is composed of American ships. It has compelled the Shipping Board to carry in its own vessels, under a system of managing operators, the far greater majority of our foreign overseas commerce.

Delays and postponements of the time of settlement of the shipping problem have injured our merchant marine and our foreign trade. If the House of Representatives is not given an opportunity to act on this measure before the appropriation bills of the short session come up, there is no telling when action can be obtained. In other words, the time has arrived when the needs of the country demand a showdown on the question of protection for the American merchant marine.

Protection has been freely given to our manufacturing industry. It has raised our standard of living, which affects every other industry, including shipping and shipbuilding. It has made domestic investments inviting and it can be safely said that American capital will not seriously attempt the shipping business until protection is assured.

Protection is right in principle until an industry is able to stand on its own feet. The shipping bill contains many provisions for developing our shipping. It is based on the facts and findings of the best committee of marine experts, irrespective of their political affiliations, that the Administration could get together. There will be an honest difference of opinion on some of the features which are more or less discriminatory in nature but the main provision, whether it is called a subsidy, compensation or a retaining fee for National defense should be favorably acted upon immediately.

The Jones Act compels the Shipping Board to operate our vessels under Government ownership until private capital can be interested in taking them over. The present board is doing this work as efficiently as it is possible to do it where the incentive of private interest is lacking. Government ownership is an abomination to the average business man but it is better to maintain a merchant marine under the present conditions than to drop back to where we were in 1914. If the Great War demonstrated anything, it proved the fact that a merchant fleet is necessary for our commercial prosperity and absolutely essential for the security of the Nation.

The Cost of New Ships

A STUDY of the bids offered for the construction of vessels during the last two months indicates that the bottom prices have been reached and that prospective owners who are delaying placing their orders will lose rather than gain by playing a waiting game. It is known that quite a number of coastwise vessels are contemplated for which contract plans and specifications have been or are being prepared. Special types of vessels for foreign commerce are also under consideration and the passage of favorable shipping legislation would undoubtedly bring them out.

While it is not believed that a contract for the construction of a new ship can be placed as cheaply as it could have been last spring, nevertheless better prices can be obtained now than in the future. In this connection the recent raise in the wages of the employees of the United States Steel Corporation, the continued increase in unfilled steel tonnage orders, the results of the railway strike and the coal strike are very good indications that the cost of both wages and materials is upward.

It is true that several shipyards have made sacrifices during the last year in order to get contracts so that they could hold their organizations together. But this will not be repeated except in exceptional cases for reorganization and

retrenchment having been accomplished and there is nothing to be gained by taking a contract that means a loss.

Shipowners should realize that shipyards are governed by the same laws that apply to other lines of business. They can produce the cheapest only when the volume of work is sufficient to keep all of their departments constantly busy. Therefore to hold up work, particularly on a rising market, until the shipyards are in a position to demand high prices, as they certainly will be if the subsidy is passed, is almost certain to result in a loss of both time and money.

Reserve Engineers

THOSE who have followed the sea or lived in the desert never forget. Whether it is the vastness of the ocean on the one hand or the lone level sands stretching far away on the other, there is a fascination for those who have traversed these great bodies of land and water which typifies as nothing else on this earth of ours the greatness of the universe that once felt will always remain.

So we are glad to learn that the engineers which the shipping depression have cast upon the beach have formed a shore division of the Ocean Marine Engineers' Association. These men who, temporarily at least, are forced to seek employment ashore hold sea-going certificates of which they are justly proud. And the possession of one of these tickets entitles the holder to mingle with the men on active sea duty and keep in touch with the news of the sea.

Without such an organization the whereabouts of the engineers leaving the beach would become unknown. The Government would thus lose a ready means of manning their ships in a time of emergency and this would be no small undertaking; for a minimum of four engineers is required for each vessel. So it is hoped that this organization of reserve engineers will meet with encouragement and the best way we can help these men who are loyal to the sea but must have work is to advise the Ocean Marine Engineers' Association, 15 Whitehall Street, New York city, of any job on a stationary plant that comes to our attention.

The South Has the Most to Gain

ALTHOUGH the shipping bill has not been made a party measure, nevertheless the chief opposition to it lies in the Democratic party. The senators and representatives from the South must be blind to the interests of their section of the country, if they allow their deep rooted prejudices against protection to influence their votes against a subsidy for shipping.

Knowing, as they must, that Southern ports are nearer to the great continents of South America and Africa and, at the same time, closer on the average to the center of production of the United States, which is a short distance southwest of Indianapolis, Indiana, it seems unbelievable that any Southern statesman would oppose any reasonable legislation that would develop our carrying trade under the American flag.

With Europe impoverished, no part of the country has more to gain from the development of American foreign commerce in the next fifty years than the South. Africa and South America are two vast undeveloped sections of the world. Their natural wealth and almost unlimited resources present opportunities to American genius and capital that are not to be compared with anything that Europe has to offer. Both of these continents look to the United States for the money, equipment, materials and skill that are necessary in a period of development.

If the Southern representatives vote against the shipping bill they will be doing nothing less than opposing the building up of a very lucrative trade that would naturally flow through the ports of the Southern states. And, furthermore, they would be directly aiding England and Germany with their advantage of cheap production to obtain for themselves the trade of Africa and South America. The United States cannot hope to secure her share of this commerce which will probably be greater in value than that from any other countries for some time to come if she does not bend every effort and utilize every opportunity to facilitate its development.

Prohibition That Does Not Prohibit

THE enforcement of Attorney General Daugherty's ruling will not cause the high seas to be one bit dryer. It will simply mean that those who desire the privilege of drinking wines and liquors *en voyage*—and in this class must be included a large percentage of Americans as well as foreigners—will select vessels over which we have absolutely no jurisdiction outside of the three mile limit.

Attorney General Daugherty holds that the intent of the framers of the eighteenth amendment in the light of the context was plainly to prevent the transportation or consumption of liquor wherever the United States held jurisdiction. We believe that the question of selling liquor on ships never entered their minds because there were so few American passenger ships engaged in foreign trade at that time.

One of the greatest arguments in favor of national prohibition was that it was impossible to keep one State dry while its neighbor was wet. This is just as true of vessels plying on the same route. Foreign vessels cannot be controlled and there will be an inducement to every member of the crew of American vessels to become bootleggers.

Neither is it the custom to examine passengers' baggage on embarkation. To do so, if it can be legally done, as the Constitution forbids the customs to tax exports, would be only one more incentive to avoid American ships and not to do so would mean that a large percentage of the class of people who can afford to travel abroad would carry their own. Whatever may be one's personal opinion of prohibition he certainly knows that it is far better to have the sale of good liquor under the control of the captain of the ship than the uncontrolled indulgence in bad liquor in the staterooms at all hours of the day.

If the passengers on our ships were limited to Americans, enforcement of the Volstead Act would be more consistent but we rely on securing our share of the foreign passenger trade. In preventing citizens of other countries from enjoying their customary beverages we are adopting a "holier than thou" attitude which is bound to work to the disadvantage

of American ships in more ways than one. For instance, in order to build up foreign trade, we have to do business with merchants of other countries. If these merchants when traveling on American ships feel insulted or, on account of prohibition, elect to travel on vessels of our competitors, we are apt to lose their trade. And this trade is vital to the prosperity of every employer and employee in the country.

Attorney General Daugherty's ruling also affects every American cargo ship in the foreign trade; for our vessels will be prohibited from accepting shipments from one foreign port to another, if there is any liquor in the manifest. Taking it from whatever angle you wish, this ruling will accomplish nothing but harm to American vessels. And by placing such a handicap on our merchant marine, we may find in a time of emergency that we lack the vessels that would give our Navy the power to prevent just such a catastrophe as occurred in 1914.

However, there are many ways in which a prosperous merchant marine could save us vast sums today. Mr. Plummer stated in his address that 68 percent of the import and export business passing through Vancouver, B. C., last year was American. What a loss this was to the American railroads passing through the Middle West!

Indeed, both American rail and water transportation bear a vital relation to our business prosperity. And they should be co-ordinated so there will be no necks of the bottle in the future where railroad cars are backed up in the freight yards waiting for an opportunity to get their contents aboard ship. A subsidy is needed to place American ships in a position efficiently to serve the railroads and the country but foreign lines will pay for that subsidy in loss of business. It will take time for the railroads to catch up with their equipment but a close co-operation with American shipping would mean a material increase in efficiency through expedition in handling cars at seaport terminals and in other ways.

Co-operation of Rail and Water Transportation

ONE of the most important provisions of the pending shipping bill is that which provides for the creation of a joint board made up from members of the Interstate Commerce Commission and the United States Shipping Board; this board to have the function of securing proper co-operation of rail and water transportation.

Once again the prosperity of our farmers is vitally affected by the lack of adequate railway facilities. According to an address recently delivered by Mr. Samuel O. Dunn before the annual meeting of the Associated Business Papers, "the farmers cannot ship the crops they already have harvested, and the wheat has not all been threshed and the corn is not yet gathered. Every single industry in the country is reporting that its shipments, and many that their production, are being restricted by lack of transportation."

The railroads lack freight cars and locomotives while the merchant marine has a surplus of cargo ships. Government regulations preventing the railroads from earning adequate returns on their capital is the primary reason why the railroads have not expanded sufficiently to take care of increased production. Lack of Governmental protection against the international competition of cheap wages and cheap building costs has been the cause of our marine troubles.

In both cases these short-sighted policies are causing enormous losses. Commissioner Plummer, of the United States Shipping Board, in an address before the Convention of Industrial Engineers on October 18 said, "the fact that the grain producers of Nebraska and Iowa alone within the last month lost one hundred and fifty millions of dollars for the reason that there has been a complete breakdown of transportation, due to the starvation of our railroads for several years, shows why the people of the Middle West have a special interest in securing adequate transportation for their products." It does not seem possible that there will be a lack of ships for some time to come but it is only a short time since our farmers and business men lost hundreds of millions of dollars because there were neither foreign or American ships to take their goods.

The Shipbuilding Outlook

IF the statistics of the past are any indication of what the future has in store, then the prospects are good for a renewal of activity in the shipbuilding industry. Whether the United States receives its share of the new tonnage is another matter and of course depends largely on the shipping policies adopted by this Government.

From a summary of the age and size of steam and motor vessels from the 1922-23 edition of Lloyd's Register Book, we are informed that there are 61,342,952 gross tons of steam and motor vessels of 100 gross tons and over in the world today. This compares, according to the figures of the Bureau of Navigation, Department of Commerce, with 45,403,877 gross tons of steam and motor vessels of 100 gross tons and over existing in the year 1914.

Returning to Lloyd's Register Book we find that 7,068,449 gross tons of existing shipping are over 25 years old and 5,888,923 gross tons are over 20 years old. As 20 years is considered the period of useful life for a ship, 12,957,372 gross tons of ships are now due for the shipbreaker. Added to this, by admission of the Shipping Board, at least, 3,000,000 gross tons of the American vessels built during the war are not efficient and should be scrapped. Next, for the purpose of comparison with 1914, we must remove at least 3,500,000 of the existing 4,806,400 gross tons of oil tankers as this class of vessel is the result of the development of oil for fuel. Removing these 19,457,372 gross tons from 61,342,952 gross tons leaves 41,885,580 gross tons today as compared with 45,403,877 gross tons in 1914.

Now Secretary Hoover recently stated that the world's commerce doubles every 15 years. The value of our foreign commerce in 1907 was $3,315,272,503, and last year, in spite of the depression, it was $6,994,178,926. English shipyards are experiencing a marked revival in new contracts and we may be sure that our maritime rivals are planning for the future. It is our opinion that the world commerce will more than double during the next 15 years and in such places as China, South America and Africa an even greater increase is probable. Are we going to get our share of this business?

The A B C of the National Shipping Bill

Common Sense Answers to Pertinent Questions Concerning the Proposed Shipping Legislation

By C. A. McAllister

Q. What is a subsidy?

A. Standard Dictionary says: "Pecuniary aid directly granted by Government to an individual or commercial enterprise deemed productive of public benefit.

"Synonyms: Aid, allowance, bonus, bounty, gift, grant, indemnity, pension, premium, reward, support, etc.

"Illustration: A nation grants a *subsidy* to an ally, pays a *tribute* to a conqueror."

The authors of this dictionary could not have expressed the present situation in shipping in better terms. Unless we pay a *subsidy* to our own ally (American ships in the foreign trade) we will have to pay a *tribute* to our (commercial) conquerors.

Q. Should the pending bill be called a "Subsidy Bill"?

A. Yes, if we stick to the dictionary definition as we should, but in the minds of many prejudiced people the term "Subsidy" is taken as synonymous with some subtle kind of graft, or the giving to shipowners of something they do not earn. A better term would be a payment to shipowners as a "Retaining Fee" for keeping their vessels ready for instant use in the national defense, and to use them in times of peace to market our surplus products abroad.

Q. If foreign ships can and will carry our products cheaper than we can carry them, why not let them do it?

A. There is every reason why we should not do so, the principal of which are:

(*a*) We must sell our surplus products of the farm, mine and factory in the same competitive markets in which the owners of the foreign ships are trying to sell similar surplus products of their own. A swell chance we will have to sell our goods from our rivals' delivery wagons!

(*b*) Every merchant ship we have under our own flag is needed for our national defense in time of war. In a world wide war such as we have just emerged from, and which may happen at any time again, if we had only fighting ships upon which to depend, we would be as impotent as fire engines without hose connections to hydrants trying to fight a conflagration.

(*c*) Abraham Lincoln once said in defense of the principles of protection: "If I buy a pair of trousers abroad for $10, I have the trousers and they have my $10; if I buy them at home for $12, I have the trousers and we have the $12 at home." The same reasoning applies to our owning ships: We have the ships and keep the freight money they earn in our own pockets.

Q. How long will we have to subsidize ships?

A. In all probability, within ten years we will have learned the shipping business and applied American talents and methods to the problem, so that at the end of that period our merchant marine can look after itself. Just remember that when we started to manufacture steel, now one of the greatest of our industries, our mills could not compete with foreign manufacturers any better than our ships, now unaided, can compete with foreign ships. By a wise system of protective measures during its infancy, the American steel industry now leads the world and brings millions of dollars of reserve to our people. Many others of our leading industries have been built up in the same manner. Had it not been for the wide vision and constructive attitude of our statesmen in the past generations, America today would have been purely an agricultural country and not the leading manufacturing and commercial country of the world. Let the present generation of statesmen prepare for continued prosperity by enacting this most essential legislation to make permanent an efficient merchant marine under our own flag.

Q. Cannot American ingenuity overcome our handicaps in shipping?

A. That is an entirely mistaken assumption, based on our national self-conceit. In the foreign shipping business we are, as yet, but novices and have much to learn. Other nations have inventive geniuses as well as we.

The greatest modern invention looking towards economical propulsion of ships is the Diesel engine, invented by a German. Other nations have made vast strides in adopting this engine, while we have just started. Unless the industry is protected in its infancy by our Government, as all other nations have done for their start in shipping, we cannot be counted among contenders for our own overseas trade. After a reasonable period of protection, say ten years, it is quite probable that American methods and inventions may, by that time, have given us sufficient shipping experience and resourcefulness to keep in the contest unaided.

Q. Why are ships of such great importance anyhow?

A. In the beginning according to Biblical history and scientific deduction the entire surface of the globe was covered with water. Today over two-thirds of the surface is water. The land is divided up among some 17,000 islands, more or less, as continents are merely overgrown islands. The human race, ever restless, wanders from land to land and exchanges commodities in order to live. Hence since the beginning of the earth's habitation ships have been one of the most important factors in the development of the human race, and will continue so to be, unless aviation develops to such an extent as to replace water navigation. Even at that, aircraft are but ships in another form. Without ships America would never have been discovered and settled, so the very existence of this country is due to shipping.

Q. What interest has the farmer in shipping?

A. More, perhaps, than any other branch of industry. In the first place we produce fifteen percent more goods in this country than we can ourselves consume. Unless we have our own ships to dispose of this surplusage of the farm, mine and factory the country cannot, as a whole, be prosperous. Foreign ships will not aid us in finding markets for our exports. Unless the country at large is in a prosperous condition the farmer cannot sell in our own country at prices which will pay him to raise food products for a people whose buying is restricted to absolute necessities to maintain life.

From 1914 to 1916, the first years of the Great War, the farmers could not get their cotton, wheat, beef, pork and corn out of the country, although the demand was great, because we had no ships of our own and the merchant vessels of the countries we had been depending upon for ocean transportation were either too busily engaged by their own

Governments or were afraid to take the risk of being captured by the enemy. The result was that all our seaports were congested with vast quantities of farm products and the men who raised them could not get their money although sales had been made.

If we are put out of the overseas shipping business, foreign vessels can make the rates so high as to debar the products of our farms, until all available wheat, cotton, etc., from competing countries have been sold. In the past summer, when the nation-wide coal strike had forced us to buy thousands of tons of coal abroad, the freight rates on that indispensable commodity started to soar. We had many ships laid up, and as soon as a number of them were put into the coal business, the freight rates immediately dropped.

Suppose we had had no ships of our own, what would have happened? Let the farmer apply this condition to his wheat, corn, pork, beef and other products.

Q. Will not this proposed legislation benefit only the shipping trust?

A. An American shipping trust exists only in the brain of the cracker-box orator and his kind. There are about 1,500 ships under the American flag (of over 1,500 tons burthen), which could be used in our foreign trade. Of these, the Government itself owns over 80 percent. The remainder are distributed among 72 firms and many individual owners, the largest single privately owned fleet consisting of 53 vessels.

Competition is so keen among these ships and with foreign ships, that the laws of the United States recognize and permit conferences to be made, in order to stop rate cutting to such an extent as to cause financial ruin to the shipowners engaged in certain trades.

In the American shipbuilding industry competition is now, and has been for many years (excluding the four year war period) so keen that many yards have been forced into bankruptcy. Many more will follow unless the Government aids shipping. Without ships and shipbuilding facilities this country will be on an island, depending on the ships of our commercial rivals for ingress and egress. If the time comes when we must defend ourselves from foreign aggression, we will be as helpless as a lion without teeth or claws.

Q. Will not the cost of this subsidy bill be a great burden on the taxpayers?

A. Positively it will not; on the contrary, it will save money to the taxpayers, for the following reasons:

(*a*) The pending measure only provides subsidies for a period of ten years. For the first year the cost will only be $15,000,000. The average cost for the entire period will not be over $40,000,000 per annum, according to expert testimony.

(*b*) We are now spending at the rate of $50,000,000 per annum to operate the Shipping Board fleet, which is found absolutely necessary to carry on our foreign trade and to prevent exorbitant freight rates being levied on us by foreign carriers. Almost all this sum will be saved by selling the ships to private operators.

(*c*) We now have over 10,000,000 tons of ships in the possession of the Government, as a direct salvage from the Great War. As private owners cannot operate them successfully, there is but little demand for them and they are laid up. Vessels not used, no matter how well cared for, rapidly deteriorate. Some are being sold at ridiculously low prices, because that is now the only way they can be sold. The recent sales of Government-owned ships do not average much over $10 per ton. If this bill is passed, and private owners can operate the ships successfully by means of its benefits, the sale value for the remainder of the Government fleet will advance rapidly. This enhancement of value alone should more than offset the entire ten years' cost of the subsidy, so it is plainly to be seen that the taxpayer will be directly benefitted by a reduction instead of an increase in his taxes.

Indirectly he will be greatly benefitted by the increased sales of our goods in foreign markets, and the general prosperity which such will bring. For example, the leading Shipping Board line to South America, while being operated at a comparatively small loss, succeeded in increasing its trade to the ports at which its vessels touch 107 percent in one year. All branches of our industries benefit by such an increase, directly or indirectly.

Q. Why does it cost more to operate ships under the American flag than under foreign flags?

A. Simply because Americans in every walk of life are accustomed to, and demand, higher standards of living, more comforts and more luxuries than the people of any other nation under the sun. Every industry and profession in this country is protected, either by a tariff or by over 3,000 miles of sea, except our shipping engaged in the foreign trade. The latter must meet the fiercest competition from the shipping of all other maritime nations, as soon as our vessels leave our ports. You cannot expect Americans to build our ships and work at the same rate of wages paid in foreign shipyards, nor can you expect our citizens to go to sea and operate our ships at the same rates of pay fixed by lower standards of living in foreign countries and paid to the men on foreign ships. Experts have conclusively demonstrated that under normal conditions the workmen in American shipyards and the crews on American ships must be paid 25 percent higher remuneration than men similarly employed in building and manning foreign ships. With a tariff on all competitive commodities, and immigration restrictions on all branches of the labor market, would it be fair to make our men in the shipyards and on our ships work without protection of some kind from their government? Our forebears all came to this country because of the greater opportunities and better living conditions in this country. Why not keep up the standards established here in the only branch of industry not now protected in some direct or indirect manner?

Q. If we amend and modernize our navigation laws, will not our ships then be able to compete for the ocean trade?

A. Such a procedure will help, as certain portions of the laws and regulations do need to be amended. It has been proposed that we adopt the Merchant Shipping Act of Great Britain in its entirety, so that our ships would be as little restricted and hampered as English ships are reputed to be. Even if we did that, helpful as it might be, American ships could not compete with British ships. In reality, although there has been much oratory and many editorials expended in railing against our so-called "moth-eaten" navigation laws, they are not nearly so bad as we have been led to think. Three years ago a committee of expert shipping men appointed by the Shipping Board spent several months in studying the various laws relating to ships and found but a few changes to be necessary. The laws are now being re-codified in consonance with that committee's recommendation and will soon be presented to Congress for its action.

The much discussed and condemned Seaman's Act was found to need amendment in but a few respects, to make it entirely acceptable to these practical shipping men. As a noteworthy example of the findings of this committee, it is but necessary to consider the heretofore almost universally accepted idea, that American ships were greatly handicapped by discriminations in regard to the net tonnage, assigned by our Government officials, being noticeably in excess of the net tonnage assigned by the British government to vessels of the same type and dimensions. If such were the fact, our vessels would have had to pay heavier taxes, canal tolls, port charges, etc. The Navigation Laws Revision Com-

mittee, however, found that no discriminations existed, and so reported to the Shipping Board.

Revision of our navigation laws will help in an indirect way but will be entirely inadequate to keep our ships on the seas without some direct financial help such as carried in the legislation now pending.

Q. Does not partisan politics enter into this proposed legislation?

A. If there is any one policy before the American public in which partisan bias does not enter, it is in regard to our shipping. Both the great political parties in their platforms for many years past have gone on record as favoring the rehabilitation of our merchant marine. There are, naturally, differences of opinion as to how this best can be done. Many statesmen have advocated discriminating import duties as the best solution, and in fact such a policy is now the law of the land, but both former President Wilson and President Harding are of the opinion that such policy is inadvisable because of certain treaties now extant, hence that law has not been enforced. Many people are still firmly of the opinion that the existing law would solve the problem, but there is no hope of its being enforced. In consequence the pending subsidy bill appears to be the only practicable solution. As both political parties are pledged to the upbuilding of our merchant marine, they should unite in support of what is apparently the only policy which is workable. Democrats should not forget that Thomas Jefferson, the founder of their party, was the most pronounced advocate of a strong American merchant marine. If he were alive today, it is more than probable that he would advocate the pending bill in view of the circumstances now existing. Republicans should bear in mind that their great leaders, McKinley and Roosevelt, were staunch advocates of subsidies as the best method of building up the merchant marine. Wilson and McAdoo are responsible for the existence of the great fleet of vessels we now own. To show the non-partisanship of the present measure, it is only necessary to call attention to the fact that its leading proponents in the Senate today are Senator Ransdell, a Southern Democrat, and Senator Jones, a Western Republican.

President Harding, formerly a senator from an interior state, where there is no direct interest in ship ownership, is and has been one of the staunchest advocates of the upbuilding of our foreign trade through the medium of American ships; thereby showing broad and statesmanlike vision. Grosvenor and Hanna, leaders in previous attempts to pass similar legislation, were both from Ohio, which shows that shipping is not an issue belonging to the people along our coasts, but a vital national necessity.

Q. How will the shipping bill benefit labor?

A. The creation of a permanent and efficient merchant marine by means of the Subsidy Act, will furnish additional employment to over 100,000 Americans on board ship, in the shipyards, the steel mills, the iron mines, and in the many other industries which are necessary to build and operate ships for the foreign trade. Every man thus employed must be well fed, and the American farmer will be benefited by raising and selling the food to them and their families.

Q. Why did the Washington Conference make the shipping bill imperative?

A. Without this encouragement to our merchant marine, we will build no more ships. We have, by international agreement, already stopped the building of fighting vessels. Hence, without any work to do, shipbuilding will become, in America, a lost art. Without shipbuilders and shipbuilding facilities this nation will be helpless for both commerce and for self-defense—an emasculated giant in the family of nations.

Q. What do our maritime rivals think of the shipping bill?

A. Our rivals for the world's trade view with great alarm the prospects of the passage of this bill, and their emissaries masquerading, in many instances, as patriotic citizens are spreading insidious propaganda and doing their utmost to defeat the measure. This is the strongest evidence possible why the bill will benefit America, and why it should receive the support of patriotic Americans.

Fuel Conservation Committee Starts Fuel Oil School for Marine Engineers

In line with the efficiency of operation and fuel conservation program instituted by Vice-President Jos. E. Sheedy of the United States Shipping Board, and which is being promulgated by the Fuel Conservation Committee of the Shipping Board, headed by Captain C. A. McAllister, and including in its members Commander R. D. Gatewood, Mr. E. H. Peabody, Major G. M. Talbot, Mr. D. M. Myers, Mr. Maurice Healey and Mr. F. B. Webster, an offer made by Secretary Denby of the United States Navy to the Shipping Board that a school of instruction in fuel oil burning by the Navy Department be established for the benefit of the officers of the Merchant Marine has been accepted and the school started on October 23.

Licensed American marine engineers of the grade of second assistant or higher on active duty are eligible for the course. The course is intensive, as indicated in the schedule below:

First Day

9 to 10	a. m.	Lecture on oil characteristics.
10 to 11	a. m.	Lecture on curves.
11 to 12	a. m.	Inspection of testing plant.
1 to 2.30	p. m.	Lecture on specific gravity, baume, hydrometer, viscosity, moisture and sediment, flash and fire points.
2.30 to 4	p. m.	Demonstration in laboratory of above features.

Second Day

9 to 10	a. m.	Safety precautions.
10 to 12	a. m.	Lecture on combustion—Orsat, draft gauge, pyrometer.
1 to 4	p. m.	Laboratory—operation of Orsat, draft gauge, pyrometer, interpretation of CO_2 curves and excess air.

Third Day

9 to 10	a. m.	Lecture on atomization—cleaning tips, atomizers.
10 to 12	a. m.	Demonstration of spray with tip testing apparatus, and in boiler.
1 to 4	p. m.	Laboratory work—relation of flame colors, smoke, and gas analysis.

Fourth Day

9 to 10.30	a. m.	Lecture on refractories and insulations.
10.30 to 12	a. m.	Demonstration of test furnaces.
1 to 4	p. m.	Laboratory work installing brickwork and plastic.

Fifth Day

9 to 10	a. m.	Lecture on water testing outfit and water treatment.
10 to 12	a. m.	Laboratory use of water testing outfit.
1 to 2	p. m.	Summary lecture by commanding officer of fuel oil testing plant and school.
2 to 4	p. m.	Examination.

The United States Navy, in conjunction with the Fuel Conservation Section of the Shipping Board, will conduct the course, which will be directed by Lieutenant Commander E. R. Norton. The lectures will be given by officers of the Navy and technical aides who have demonstrated the successful methods of operation on naval vessels which have made our ships the most efficient of any oil-burning vessels afloat.

Graduated Compensation of Shipping Bill Explained

Mail and Passenger Ships Receive More Than Cargo Ships Because They Cost More to Construct and Operate

By Winthrop L. Marvin*

A SUMMARY of the provisions of the National Shipping Bill, such as was contained in the October issue of MARINE ENGINEERING AND SHIPPING AGE, may logically be followed by a statement of the reasons justifying National aid, first to the cargo ships and second to the passenger, mail and cargo liners that together constitute a balanced merchant marine.

First of all, the mileage-tonnage compensation provided for cargo ships of a speed of 11 knots and less is intended by the government officials to constitute an approximate offset to the lower wages of officers and men and the lower cost of subsistence on shipboard of our principal foreign competitors, who are the shipowners of Great Britain, possessing as they do nearly one-half of the active overseas shipping tonnage of the world.

A series of careful estimates based upon actual ship payrolls, prepared by the United States Shipping Board and confirmed by the records of private American shipowners, goes to show that the basic compensation of one-half of one cent for each gross ton of a vessel for each one hundred nautical miles covered by the vessel in the foreign trade of the United States represents approximately the difference between the wage and food cost of a representative American ship and of a representative British ship of the same type and capacity.

Following are tabular comparisons of the wage scales of representative American and British steamers of a good average size, or 6,000 tons gross register, both engaged in North Atlantic commerce:

COMPARISON OF AMERICAN AND BRITISH PAY-ROLLS.

	American Scale (Privately-Owned-Ship) Per Month	British Scale Per Month		
Master	$275	£45	0	0
Mate	165	20	10	0
Second Mate	140	16	0	0
Third Mate	125	13	0	0
Carpenter	70	12	10	0
Boatswain	..	11	10	0
Able Seamen (6)	285	60	0	0
Ordinary Seamen (2)	70	11	0	0
Chief Engineer	250	24	10	0
Second Engineer	165	20	10	0
Third Engineer	140	16	0	0
Fourth Engineer	125	13	0	0
Deck Engineer	70	11	10	0
Oilers (3)	165	33	0	0
Firemen (9)	450	94	10	0
Coalpassers (3)	120	30	0	0
Steward	105	14	10	0
Cook	90	13	10	0
Second Cook	70	9	10	0
Messboys (3)	90	8	10	0
Radio	90	13	10	0
	$3,060	£492	0	0

Pound sterling converted @ $4.43	$2,179.56
American scale	$ 3,060.00
British scale, present exchange, $4.43=£1	2,179.56
Difference	880.44
Subsistence difference	240.00
Total monthly difference	$ 1,120.44

*Vice-president and general manager, American Steamship Owners' Association.

Annual difference for 11 months at present rate of exchange $12,324.84

Compensation, as proposed, 6,000 tons gross × $0.005 = $30.
Allow 35,000 miles per year = $10,500 annual compensation for this type.

These wage scales respectively embody the standard rates in practice at the present time on American and on British cargo steamers, with white crews. It is made clear that the American steamer, considering both wage and subsistence costs, is at a disadvantage of $1,120.44 per month, or of $12,324.84 for eleven months, as compared with its British competitor. According to the best available estimates, the 6,000-ton American steamer, on a basis of a subsidy of one-half of one cent for each gross ton for each one hundred nautical miles traveled in the foreign trade, will earn a total compensation or subsidy in eleven months of $10,500. This subsidy of itself falls somewhat short of meeting the higher wages and subsistence of the American ship, so that the indirect aids in the National Shipping Bill must be depended on for the exact equalizing of conditions between American and British cargo steamers of like type and tonnage. It is obvious from these facts as given that, so far as the compensation or subsidy is concerned, not a dollar of it can rightfully be regarded as a bonus for the shipowner. Every dollar of this compensation goes into the pockets of the American officers and seamen, who are the direct beneficiaries of the proposed legislation.

Competitive Conditions Make Compensation Necessary

It may be urged that American shipowners are now operating steamers in the foreign trade, and are paying out of their own pockets the difference between American and British wages and subsistence. So they are, but nothing is more unmistakable than that they cannot and will not continue so to do, any more than they were operating ships and paying higher wage and subsistence costs before the world war, when, as is generally known, the American flag, except as borne on a certain few subsidized mail routes, had virtually left the ocean, and more than nine-tenths of our export and import trade was being conveyed by the ships of foreign nations. What was once will most certainly be again, unless the full compensation proposed in the National Shipping Bill, to even up competitive conditions and give American ships a fair chance, is promptly and fully made available. If the proposed compensation is not given, experience demonstrates that American cargo ships will be forced out of overseas trade, and their officers and men will cease to exist as seafarers.

There is agreement among an overwhelming majority of the American people of both political parties that the tariff laws of the United States shall be so adjusted as to give American labor a fair chance against competing foreign labor in manufacturing and in agriculture. Can any man who calls himself an American give a reason why there should not be equivalent fair play for our labor on the sea?

Increased Compensation Required for Faster Ships

For passenger, mail and cargo steamers operating on regular lines, and generally of a speed of from 12 knots upward, graduated, increasing rates of compensation or subsidy are

provided by Section 404 of the National Shipping Bill. For ordinary cargo steamers of 11 knots and less, generally described as of the "tramp" class, though running on regular routes, the rate of compensation, as has been said, is one-half of one cent for each gross ton for each one hundred nautical miles traversed in the foreign trade. The 12-knot steamer, the lowest speed that is likely to be employed in the passenger, mail and cargo service, is given by the Shipping Bill an additional compensation of one-tenth of one cent, if her speed is 12 knots or less than 13 knots; of two-tenths of one cent, if her speed is 13 knots and less than 14 knots—and so on upward until an additional compensation of two and one-tenth cents per gross ton for one hundred nautical miles sailed is provided for steamers of a speed of 23 knots or more—or a total compensation for such ships of two and six-tenths cents per gross ton for each one hundred miles covered.

The reasons for this graduated increase of compensation to the faster ships are that these faster steamers invariably cost more money to build and operate and, therefore, involve a very great increase in capital investment. A Senator, criticising the terms of the National Shipping Bill, recently asked why a 10,000-ton cargo steamer should receive compensation of only $15,000 a year, while the *Leviathan* would receive $900,000.

Compensation for Leviathan Analysed

This is an extreme comparison. There are many 10,000-ton cargo steamers, but there is only one *Leviathan* under the American flag. Ten thousand-ton cargo steamers were being built in American yards before the world war for from $60 to $65 per deadweight ton. Such ships during the war, because of the emergency, and soaring prices of materials and wages, cost as high as $200 per deadweight ton. But 10,000-ton cargo steamers are being sold in all countries now at an average price of $30 per ton. It is understood that the *Leviathan* originally cost in Germany before the world war about $7,000,000 to construct, and approximately $8,000,000 is now being expended for the reconditioning of this mighty steamer.

Considering further, that the 10,000-ton cargo steamer can be navigated by 35 men, while the *Leviathan* has required a crew of 1,000 men—and considering the difference in the cost of stores and fuel which the cargo ship and the *Leviathan* will consume, it is manifest that the 10,000-ton cargo steamer is not over-compensated nor is the *Leviathan* over-compensated, though the latter ship may receive $900,000 a year. The British government, it should be remembered, gave a subsidy to the Cunard Line in 1903 of about $1,050,000 a year for the two ships *Mauretania* and *Lusitania*, after having lent, at the low interest rate of 2¾ percent, about $12,000,000 for the construction of the two steamers. The *Mauretania* is of 30,000 tons gross register. The *Lusitania* was of 30,000 tons gross register. The *Leviathan* is of 54,000 tons gross register. If the *Leviathan* receives a compensation or subsidy of $900,000, or $16.67 per gross ton per year, it will be not dissimilar from the total annual subsidy of $17.50 per ton per year which the British government gave under a twenty-year contract to the *Mauretania* and *Lusitania*.

All Maritime Nations Have Aided Establishment of Passenger Lines

All maritime governments in the world have found it necessary in the last eighty years to pay considerable sums of money to create and to maintain their National lines of passenger, mail and cargo steamers. Great Britain was the pioneer in this subvention or subsidy policy, beginning with the founding of the Cunard Line in 1839, with a subsidy of $425,000 a year. There is not the slightest reason to believe that the United States can create and maintain essential National lines of passenger, mail and cargo steamers in any other way than that pursued by Great Britain, France, Germany, Japan, Italy, Spain or any other nation that has owned or owns fleets of express ocean steamers. Historically, all such large, fast vessels of the naval reserve have been subsidized, or if not subsidized have received equivalent compensation. This is the purpose of the paragraphs of Section 404 of our National Shipping Bill, which provide graduated increasing rates of compensation for regular passenger, mail and cargo services of a speed of from 12 knots to 23 knots and upward. The problem is different from the problem of the cargo ships pure and simple, where the compensation provided is only enough to cover the difference in wage and subsistence costs between like American and foreign vessels.

Liners under all flags and in all times have demanded special consideration from their governments. The cost of constructing and operating steamers of more than ordinary commercial speed fitted for mail and passenger service is such that these fast services have under no flag been able to succeed without very generous National assistance. Cargo steamers of from 9 to 11 knots, out of the excess of tonnage built during the world war, are now being sold in all countries for an average of $30 per deadweight ton. Passenger, mail and cargo steamers of more than usual commercial speed would cost, if now constructed, all the way from five to upwards of ten times as much per ton, and would cost correspondingly to maintain and operate. These are substantially the main reasons why the rates of compensation provided for liners in the National Shipping Bill are higher than for 9 to 11-knot cargo or "tramp" steamers.

The United States Shipping Board has a small fleet of existing mail, passenger and cargo steamers for sale, but the cost of these, if they are relatively new ships, has been the equivalent of many times $30 per deadweight ton. And as to the older German ships, the cost of these also will prove exceedingly high when they have been properly reconditioned for liner service.

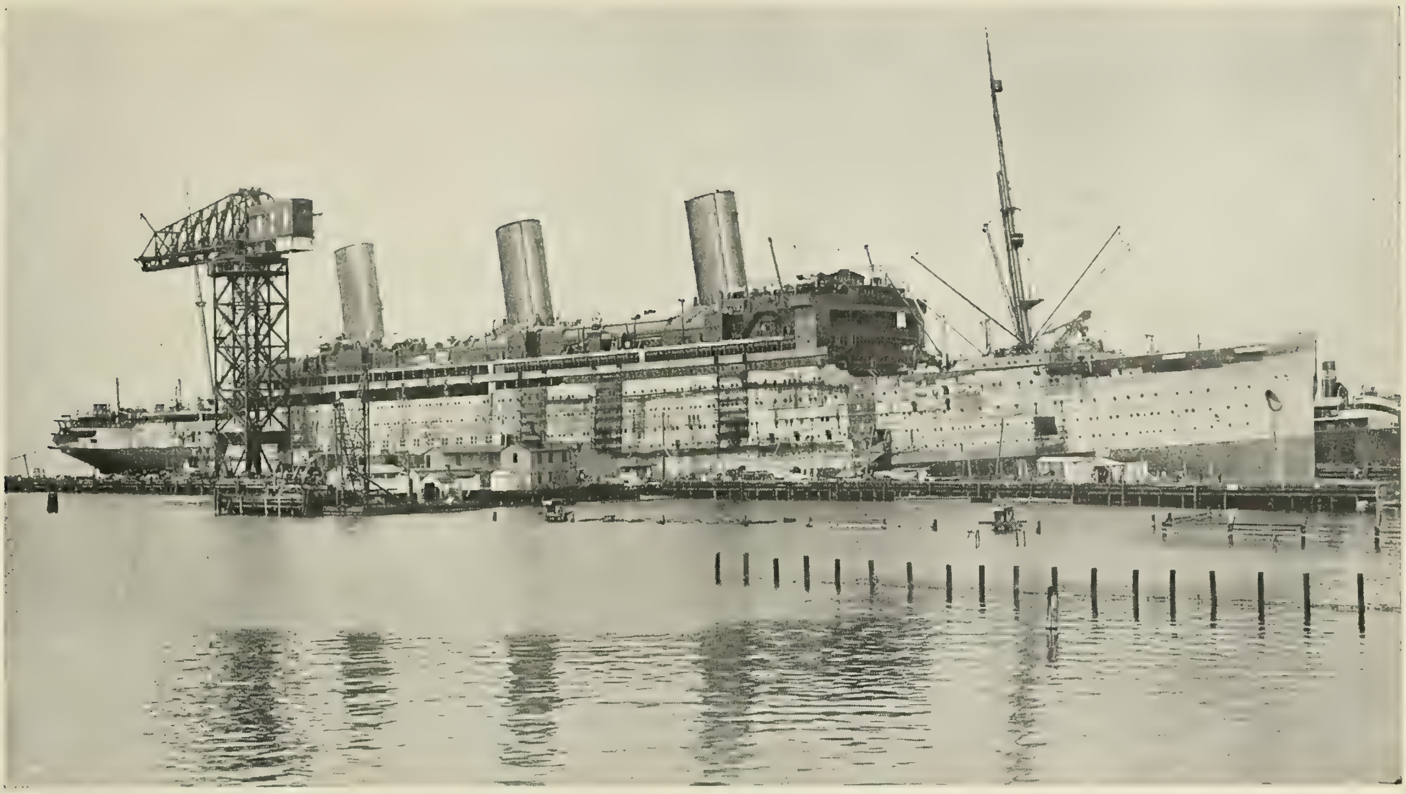
New Tariff Rates in Ceylon

Consul Vance, Colombo, cables the Department of Commerce that the new customs tariff of Ceylon which went into effect provisionally from August 25, as announced in *Commerce Reports* for September 4, has been adopted with certain modifications. The import duties on motor trucks, cotton goods and fish are to remain unchanged, while the advance on automobiles, motorcycles and soap is more moderate than had been proposed. The final rates on the more important articles of trade with the United States are as follows:

Articles	Former duties Ad valorem	New duties Ad valorem
Automobiles	7½ percent	10 percent
Motorcycles	7½ percent	10 percent
Motor trucks	7½ percent	7½ percent
Toilet soap	7½ percent	10 percent
Agricultural machinery run by other than human or animal power	Free	2½ percent
Cotton goods	5½ percent	5½ percent
Fish, dried or salted, per hundredweight	Rupees 0.75	Rupees 0.75
Meat, frozen or refrigerated	Free	2½ percent Ad valorem
Paper machinery	Free	2½ percent
Articles not specified	Ad valorem 7½ percent	Ad valorem 10 percent

The proposed advance in the export duty on tea grown on the island has been increased from 1½ Ceylon cents to 3 cents per pound.

The duties in Ceylon apply equally to imports from all sources.



View of Steamship Leviathan at Fitting Out Pier of Newport News Shipbuilding and Dry Dock Company, Showing 120-Ton Hammer Head Crane on the Pier for Placing Heavy Equipment on the Vessel. Hanging Scaffolding Can Also Be Seen Along the Side of the Vessel Used in Scraping and Painting the Topsides of the Hull

The Reconditioning of the Steamship Leviathan

Newport News Shipbuilding and Dry Dock Company Converting the World's Second Largest Vessel Into the Finest Transatlantic Liner Afloat

WHEN the proposal to recondition the *Leviathan* as a first class passenger liner was under consideration after the vessel had completed her service as an army transport during the world war, the Government was confronted with a task far greater than had ever been attempted in the history of shipbuilding. When completed in Germany in 1914 the vessel was the largest liner in the world; since then she has been surpassed in size by only one other vessel, the White Star liner *Majestic,* which, except for a matter of 2,269 gross tons increase in measurement, is practically a sister ship of the *Leviathan.*

After completion, the *Leviathan* (ex-*Vaterland*) made only three voyages across the Atlantic under the German flag, as at the outbreak of the war she was interned in New York harbor where she remained until the United States entered the war in 1917 when she was seized by the Government and pressed into service as a troopship. During the two years she was used as a transport the vessel was stripped of her furnishings and all decks below the weather deck were cleared so that she could carry from 11,000 to 12,000 troops on each voyage instead of the 3,400 passengers for which she was originally designed. After going out of commission as a transport the vessel remained idle at her pier in New York harbor for a period of two years.

Plans and Specifications Required

In reconditioning the vessel for the transatlantic passenger trade, therefore, not only was the toll of her active war service, and subsequent enforced idleness, to be reckoned with but also, due to her construction abroad, plans of the hull and machinery were unavailable, except from her original owners at a prohibitive price. The first step necessary, therefore, was the preparation from the ship itself of plans and specifications for the work.

Through arrangements made by the United States Shipping Board with the International Mercantile Marine Company, New York, this work was successfully carried out under the supervision of William F. Gibbs, chief of construction of that company. In accordance with these plans and specifications contracts were awarded by the United States Shipping Board, Emergency Fleet Corporation on February 15, 1922, to the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., for reconditioning and conversion of the vessel to an oil burner and for repairs and machinery; also to Gimbel Brothers, New York, for the equipment of the steward's department and for a library, and to Gibbs Brothers, Inc., engineers, New York, for the supervision of the work.

Cost of the Work

The cost of placing the *Leviathan* in commission in accordance with these plans will be approximately $8,200,000, distributed as follows:

Newport News Shipbuilding and Dry Dock Company

Reconditioning and conversion to an oil burner	$5,595,000
Repairs and machinery	515,000

Transatlantic Passenger and Mail Steamship Leviathan

General Information

Service: Highest Class Passenger & Mail service, transatlantic trade.
Builder: Blohm & Voss, Hamburg. Reconditioned by Newport News Shipbuilding and Dry Dock Co.
Owner: U. S. Shipping Board.

Characteristics

Length, overall	949′ 9″
Length, B. P.	928′ 5″
Breadth, molded	100′ 0″
Depth, molded to D. Dk.	70′ 4¼″
Draft, loaded, about	40′ 0″
Block coefficient	0.625
Draft, light	
Midship section coefficient	
Longitudinal coefficient	
Speed, loaded, knots	
Cruising radius, nautical miles	
Framing	Transverse
Class	American Bureau of Shipping

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	
**Weight Propelling Machinery	
Deadweight Capacity	
Displacement	66,800
(In tons of 100 cubic feet)	
Gross register, about	56,940
Net register, about	28,000

* Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.
** Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

Anchors, 1 12-ton Stockless, Bow; 2 10-ton Stockless, Bow.

Chain, 165 Fath. 4⅛″ Stud Link; 165 Fath. 3⅜″ Stud Link; 150 Fath. 3 3/16 Stud Link.

Rudder

Area, 409 sq. ft. Balanced Type.
Dia. Stock, 32″.
C. Press, abaft C. L. pintles

Complement

Deck officers	15
Deck crew	135
Engineer officers	46
Engineer crew	226
Purser's and steward's department	693
Total officers and crew	1,115
First-class passengers	976
Second-class passengers	542
Third-class passengers	944
Fourth-class passengers	936
Total passengers	3,398
Total complement	4,513

Handling Equipment

	No.	Type	Capacity	Length
Masts	2			213′
Derrick posts	4	with boom	3 ton	52′-72′
Booms	5		6 ton	
Booms	5		3 ton	
Discharg'g Cap.				

Deck Machinery

(Number, Size, Type)

Steering gear, 2 Steam, 17″x10″

Windlass, 3 Bow, 1 Stern, Battleship Type.
Capstans, 2 Bow, 2 Stern, Warping Engine.
Winches, 6 Steam, 8″x14″; 12 Steam, 7″x 12″; 1 Electric (10 tons).

Life Saving Equipment

Lifeboats	No.	Type	Length
Lifeboats	60	....	30′
Lifeboats	8	....	26′
Motorboats	2	....	30′
Workboats	2	....	22′

Propelling Machinery

Boilers

Number	46
Type	Modified Yarrow
Length	
Width or Diameter	
Furnaces	
Fuel	Oil
Draft	Natural
Total heating surface, sq. ft.	179,768
Total furnace volume, cu. ft.	24,150
Superheat, degrees F.	None
Working pressure, lbs. per sq. in.	248
Normal fuel consumption:	
Per day, tons	
Per horsepower hour, pounds	
Normal steam production:	
Per hour per pound of fuel	lbs.
Total per hour	lbs.

Engines

Number	Direct Connected Turbines
Type	Parsons Reaction
Size	
Horsepower	60,000

Propellers

Number	4
Type	Solid 4-bladed bronze
Weight	
Diameter	16′ 6″
Pitch	
R. P. M.	
Projected area	
Developed area	

Auxiliary Machinery

(Number, Size, Type)

Machinery Space

Condensers	4

Weir type, 66,564 sq. ft.

Evaporators	6
Distillers	2
Filters	4
Feed water heaters	4
Fuel oil heaters	16

Pumps
16 Main feed
4 Aux. feed
4 Ballast
6 Bilge
8 Lub. oil
4 Weir dual air pumps
2 Aux. air pumps
2 Main circ. pumps
2 Aux. circ. pumps
6 Fire and san. pumps
4 Fuel oil transfer pumps
10 Fuel oil service pumps
39 Misc. pumps

Refrigerating Machinery

3 Hor. Compound Steam Eng. Drive.

2 Aux. Motor Drive.

Electric Equipment

Turbo Generators—115 Volt.
(4) 288 K.W.; (1) 500 K.W.
Radio, Not Determined.
Emergency: 2 Batteries (1) 200 Aph., 115 Volts., (1) 600 Aph., 115 Volts.
2 Diesel Eng. Gen., each 60 K.W., 115 Volts.

Holds

No.	Length	Hatches	
1	69′ 0″	No. 1	16′0″x21′
2	75′ 0″	No. 2	20′ x20′
Hatch No. 3	Baggage and Mail		16′ x12′
Hatch No. 4	Baggage and Mail		10′ x12′
Hatch No. 5	Baggage and Mail		16′ x12′
Hatch No. 6	Baggage and Mail		15′ x12′

Capacities

Cargo Space

Compartment

1 betw. H. & L. Deck, about 39,000 cu. ft.

2 betw. H. & K. Deck, about 50,000 cu. ft.

Refrigerated Space

Compartment	Cu. Ft.
Compartments for Meat, Fish, Eggs, Vegetables, Flowers, etc.	16,600

Bunkers (Fuel Oil Tanks)

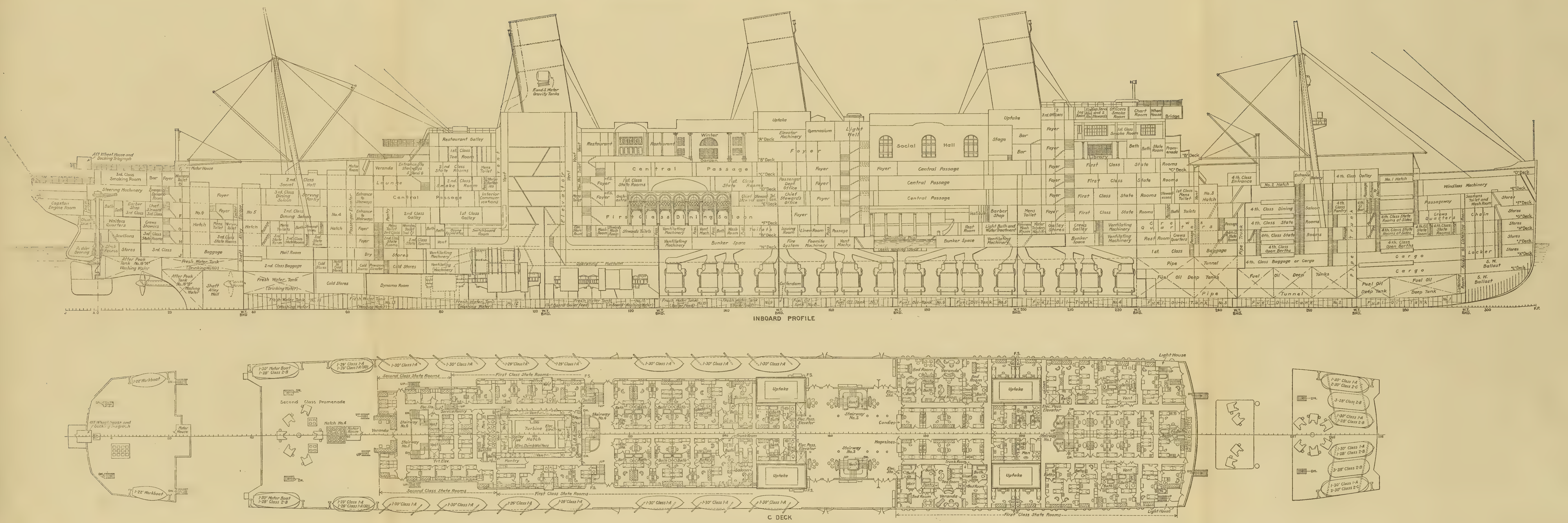
Compartment	Cu. Ft.	*Tons
Inner Bottom	120,796	3,245.6
Deep Tank	144,559	3,884.2
Wing Tanks	38,984	1,047.2
Total	304,339	8,177.0
Service Tanks	51,610	1,386.6
Grand Total	355,949	9,563.6
Fore Peak (Water Ballast Only)	5,994	171.7

*....cu. ft. per ton;..............gals., per bbl.

Fresh Water Tanks

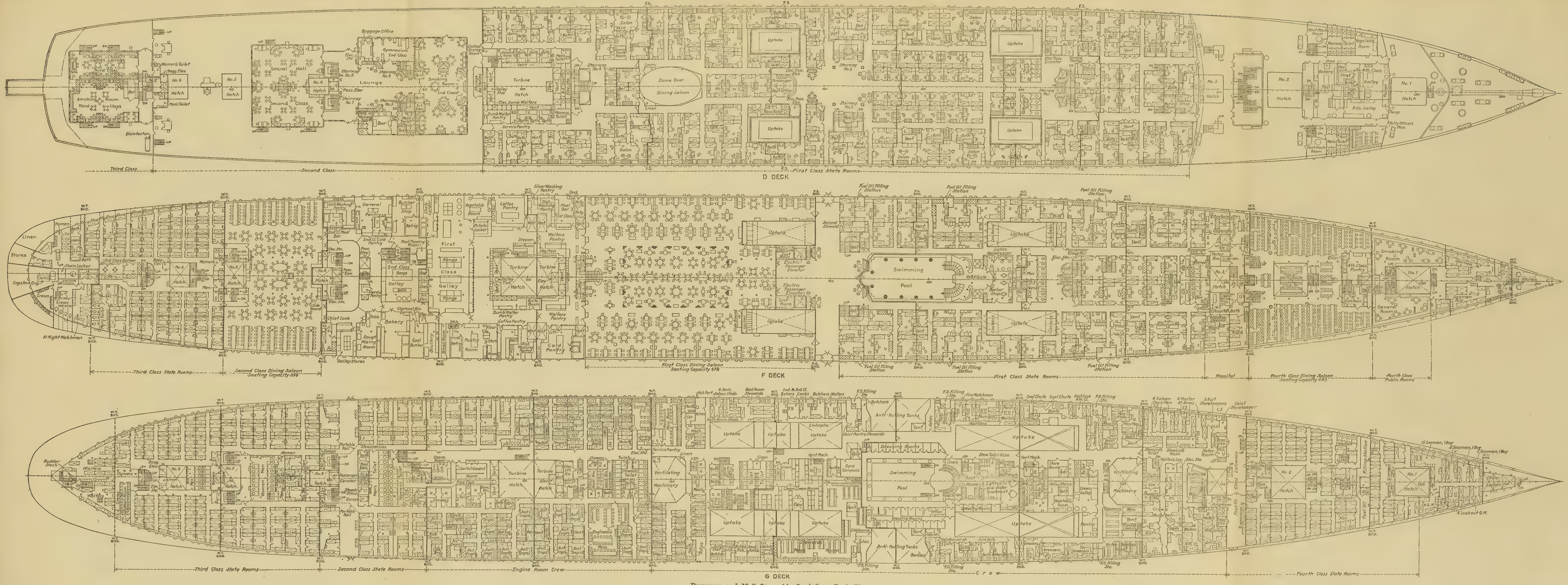
Compartment	Cu. Ft.	Tons
Inner Bottom	90,613	2,517.0
Tank No. 22	5,102	141.7
Deep Tank	7,138	198.2
Tank, K. Deck	14,031	389.7
Aft. Peak	8,267	229.6
Total	125,151	3,476.2

THE RECONDITIONING OF THE STEAMSHIP LEVIATHAN



Passenger and Mail Steamship Leviathan: Inboard Profile and Plan of C Deck

THE RECONDITIONING OF THE STEAMSHIP LEVIATHAN



Passenger and Mail Steamship Leviathan: Deck Plans

GIMBEL BROTHERS	
Equipment of steward's department	546,000
GIBBS BROTHERS, INC.	
Supervision	182,000
MISCELLANEOUS	
Moving ship to contractor's yard, insurance covering removal, new anchors and chain, moving ship to dry dock, dry docking, trial trip and maintenance and guarding of ship for 14 months during reconditioning	1,352,000
Total	$8,190,000

Upon award of the contracts the vessel was moved, under the personal supervision of Mr. Gibbs, to the yard of the Newport News Shipbuilding and Dry Dock Company, orders were placed by the shipbuilders for material, some 200 contracts were placed with sub-contractors for equipment and supplies and the work, to be completed in 14 months, was begun. As an indication of the completeness and accuracy of the plans and specifications and the efficiency and skill of the contractors it is noteworthy that up to date not a single extra charge has been incurred, a condition seldom achieved with vessel reconditioning contracts of far less magnitude.

SCOPE OF THE WORK

The work involves extensive structural changes in the hull with a view to increased strength and safety, the conversion of the vessel to an oil burner, the overhaul and repair of all machinery, the new construction of all quarters below the weather or *D* deck, the reconditioning, decoration and furnishing of all passenger accommodations and crew's quarters, installation of complete new galley and pantry equipment of the most modern type, complete new and improved electric wiring, steam heating and plumbing systems throughout the ship, improved ventilation and drainage systems, changes in the engine room and fireroom ventilation to add to the safety of the vessel, and the installation of new and improved equipment of American manufacture for the safe and efficient navigation and operation of the vessel. The work is being done under special survey of the American Bureau of Shipping to meet the requirements for the highest classification of the Bureau. In general the scantlings are all in excess of the American Bureau requirements and the workmanship and materials conform in every respect to the requirements of the United States Steamboat Inspection Service.

The vessel has five steel decks extending the full length of the hull, four decks in the superstructure and additional decks in the forward and after holds. The 13 transverse watertight bulkheads, which originally extended to *F* deck, have all been tested to *F* deck and two in the forward holds have been strengthened and made watertight to *D* deck and two others, the forward collision bulkhead and the one between boiler rooms 1 and 2, have been made watertight to *E* deck. Intermediate beams have been fitted on *L*, *K* and *J* decks forward, the double bottom forward of boiler room 4 has been converted into fuel oil tanks, fuel oil deep tanks have been built in the forward holds and service oil tanks and pump rooms in the former coal bunkers alongside the boiler rooms.

Extra oil-tight bulkheads have been constructed at frames 277, 261, 253 and 236 and a centerline oil-tight bulkhead from frame 224 to 293. The scantlings of all new construction in the fuel oil tanks are in excess of the requirements of the American Bureau of Shipping for a pressure due to a head of water up to the level of *F* deck. For the fresh water tanks the scantlings are for a pressure due to a head of water up to *E* deck.

In bringing the main watertight bulkheads up to the American Bureau requirements extra local stiffening has been provided and the size of and the riveting in the heel and head brackets of the stiffeners have been increased. During the survey of the bulkheads it was found that in several instances rivets had been omitted where holes had been provided for them and in such cases new rivets were driven up.

Due to the greater subdivision of the hull forward of the engine rooms, the strengthening and extension of the bulkheads, the elimination of many of the watertight doors in the bulkheads and the rearrangement of the ventilating systems, to the engine and boiler rooms, the protection of the vessel against flooding due to collision or grounding is substantially increased. The safety of the ship is also materially increased by the addition of 9 new firescreen bulkheads making 20 in all which are installed in the passenger quarters.

PASSENGER ACCOMMODATIONS

The arrangement of the passenger accommodations is shown by the accompanying plans. Above *D* deck, the former arrangement of the rooms, including the first class public rooms and suites, will in general be retained. Below *D* deck the passenger and crew's quarters are principally of new construction.

The interior decoration and furnishing of the first and second class accommodations, under the supervision of Walker and Gillette, architects, New York, will surpass in beauty, comfort and convenience anything previously attempted in a floating hotel. The draperies are being furnished by W. and J. Sloane, New York; the carpets (about 20,000 square yards) by the Bigelow Hartford Carpet Company, New York, and Alexander Smith and Sons, New York; the Oriental rugs (about 3,000 square yards) by Costikyan and Company, New York; equipment for the first and second class gymnasiums by A. G. Spalding, Chicopee, Mass., and furniture by the Orsenigo Company, Long Island City, N. Y., Smith and Sons, New York, and Sons-Cunningham Company, New York. Large quantities of the cabinet work are being manufactured by the Newport News Shipbuilding and Dry Dock Company. Eleven new electric elevators are being installed by the Otis Elevator Company, New York, 3 for first class passengers, 1 for second class passengers, 1 for the engineers and 6 for freight, in addition to 5 new electric dumbwaiters.

On the bridge deck numerous changes are being made in the officers' quarters, due to the reduction in size of the ventilating trunks to the boiler rooms giving space for additional rooms, including among others a library for the captain's suite and a smoking room for the deck officers. Further aft on *A* deck a similar smoking room is being fitted for the engineers.

On *A* and *B* decks are the principal first class public rooms and promenade space. On *C*, *D*, *E* and *F* decks amidships are the first class staterooms, special suites and the main dining room and galleys.

The second class accommodations are on *C*, *D*, *E*, *F*, *G* and *H* decks aft of the machinery space and further aft on *D*, *E*, *F*, *G*, *H* and *J* decks are the third class accommodations while the crew and steerage quarters are forward on *D*, *E*, *F*, *G*, *H* and *J* decks.

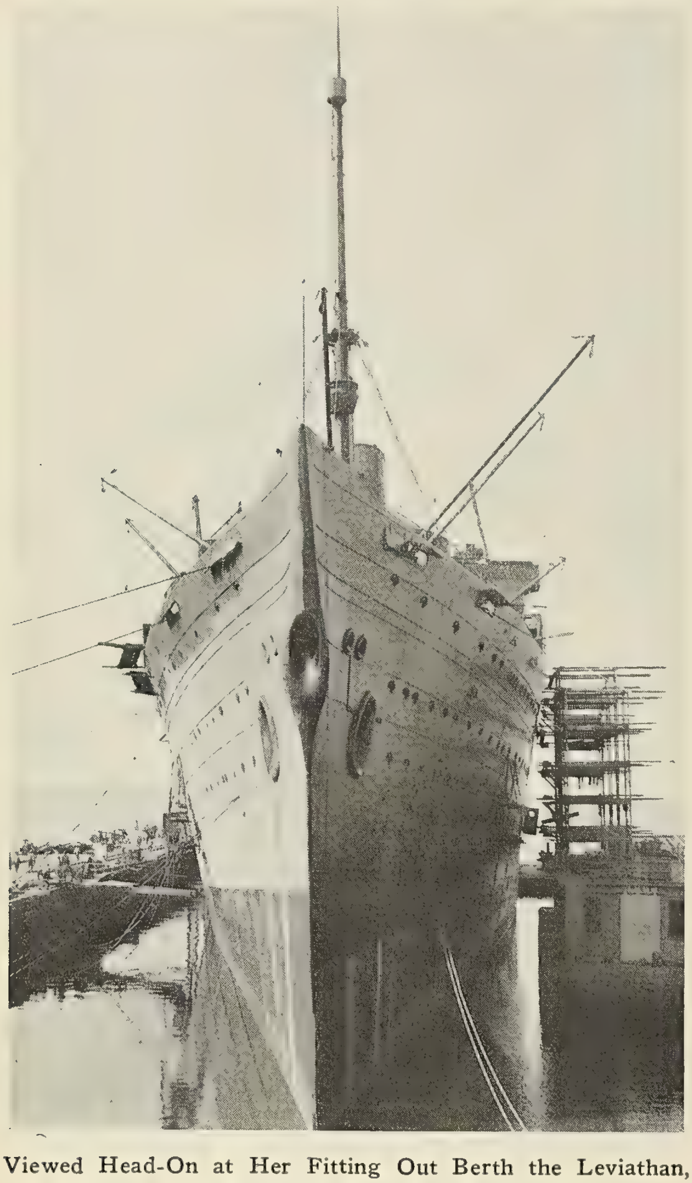
The new flooring in general is of American Lit-O-Sil-O decking, supplied by the Marine Decking and Supply Company, New York, covered with linoleum, carpet or rugs. In the new construction about 150,000 square feet of heavy plyboard either Haskelite (56,000 square feet) or Roddiswood, supplied through the United States Plywood Company, New York, and about 100,000 square feet of Vehisote, supplied by the Pantasote Company, New York, are used.

So extensive is the work being done in the new construction, reconditioning, decoration, furnishing and fitting out of the passenger accommodations that no adequate description of it can be given in the space available at this time. This phase of the work will be dealt with in a later article when the vessel is completed.

PROPELLING MACHINERY OVERHAULED

Propulsion of the *Leviathan* is by four shafts driven by direct connected Parsons turbines arranged as follows, from

forward aft: Port inboard shaft, high pressure ahead and high pressure astern; starboard inboard shaft, high pressure astern and intermediate pressure ahead; port outboard shaft, low pressure ahead and low pressure astern; starboard outboard shaft, low pressure ahead and low pressure astern. In full speed condition steam is admitted first to the high pressure, then to the intermediate and then to the two low pressure turbines. For maneuvering, steam is admitted from the boilers direct to both the high and intermediate pressure turbines and then from the high pressure to the port low



Viewed Head-On at Her Fitting Out Berth the Leviathan, in Spite of Her Enormous Size, Has the Appearance of a Swift Yacht or Destroyer

pressure and from the intermediate to the starboard low pressure turbine.

On the maneuvering board in the operating room are valves by which, in the event of the breakdown of any shaft, a change can be made to the other shafts in 3 or 4 minutes. In this way a major breakdown to the machinery could occur without affecting the safety of the vessel or her passengers in the slightest degree.

In reconditioning the ship the main turbines and all of the auxiliary machinery, fittings and equipment are being thoroughly overhauled and put in first class condition.

Boilers Converted from Coal to Oil Burning

Steam is furnished at 248 pounds per square inch by 46 Yarrow type watertube boilers located in 4 boiler rooms and the boilers are being converted from coal to oil burning. The finished installation is guaranteed to burn from 500 to 2,240 pounds of Mexican crude oil of 10.6 to 10.8 degrees Beaume having a viscosity of 6,000 Saybolt seconds at 150 degrees F. per boiler per hour under service conditions. The original coal burning equipment will be retained for possible reconversion at some future time should this become desirable.

The oil burners at the boilers, of which 5 are fitted to each boiler, are of the Peabody type supplied by the Peabody Engineering Corporation, New York.

To provide a total fuel oil capacity of about 9,563 tons of 11 degree Beaume Mexican fuel oil with the tanks 97 percent filled the following tanks will be used: 25 double bottom tanks, 13 deep tanks and 8 service tanks, all provided with connections for filling. The double bottom fuel oil tanks are all forward of frame 150 at the forward end of boiler room No. 4, where a cofferdam is built to isolate the fresh water tanks aft. The deep tanks are located in holds 1, 2 and 3 forward of No. 1 boiler room and extend up to *L*, *K* and *J* decks, respectively. The service tanks are located in the former side coal bunkers, 2 in each boiler room, 1 on either side, extending from the tank top to *J* deck, except in boiler room 4, where a cofferdam is built above the tank top to isolate the service tanks from the fresh water in the double bottom tanks below. Fifty Pneumercator gages are connected to the tanks.

The deep tanks in No. 3 hold will be arranged as settling tanks. The fuel oil will be transferred from the double bottom tanks to the deep tanks for settling and thence to the service tanks at the sides of the boiler rooms. Arrangements are made for pumping oil from any deep tank to any service tank while transferring oil from any double bottom tank to a deep or settling tank.

Oil Transfer System

Duplicate service systems are provided in the three forward boiler rooms, with pumps (9 by 6 by 10 inch vertical duplex), heaters and strainers and the transfer systems (10 by 12 by 12 inch vertical duplex pumps) are also in duplicate. Boiler room 4 will have 2 duplicate sets of service pumps of smaller size (7½ by 4½ by 10 inch) as the boilers in this room will be used in port. The oil heaters are of the Griscom-Russell type.

An adequate system of oil heating coils is provided in each service and oil storage tanks capable of raising the temperature of the oil from 40 to at least 130 degrees F.

In boiler room 4 a new donkey boiler, supplied by the Consolidated Shipbuilding Corporation, Morris Heights, New York, is installed to supply steam direct to the service pumps in boiler room 4 and to the manifold controlling steam to the oil heating coils in the service tanks in this boiler room.

Overflow System

In every compartment used for storage of fuel oil an overflow system is provided so that the highest pressure in the tank cannot exceed that due to a head of oil up to the highest point of the overflow system. The system is divided into two main sections, one for the tanks forward of the boiler rooms and the other for the tanks in way of the boiler rooms. The overboard overflows of both systems are at the side of the vessel about 5 feet above *G* deck and are fitted with nonreturn valves to prevent shipping of seas in rough weather.

Fire Protection in the Boiler Rooms

With the conversion of the vessel from coal to oil burning it became necessary to provide the utmost protection against the fire hazard involved in the handling, storage and burning of fuel oil. For this purpose a very complete Firefoam fire extinguishing system is being installed by Charles Cory and Son, Inc., New York, designers and installation engineers of the system.

In general, the system comprises two solution tanks having a capacity of 3,500 gallons each, installed on *H* deck over boiler room No. 3, which are used to store the "A" and "B"

Firefoam solutions. Two independently driven pumping units, one electric and the other steam, are employed to pump the solutions to any one of the four firerooms, or to any filling station. The Northern Fire Apparatus Company's positive displacement rotary pumps syphon the solution from the tanks and discharge into the feed lines at a rate of 400 gallons of each solution per minute. One twin unit is driven in tandem by a 50 horsepower Albergen-Curtis steam turbine and a duplicate unit by a 50 horsepower Diehl Navy standard watertight motor.

The solutions are conveyed from the pumps to the various compartments and mixed in specially designed distributors, which are installed in such a manner over the tank tops and other places where oil can collect that the foam, formed by impinging the solutions in these distributors, will be completely spread over the surface of the fire. These distributors are also placed in all filling stations on *F* and *G* decks. In addition to the distributors, each boiler room is equipped with four Firefoam hose hydrants, with the exception of No. 1 boiler room, in which there are five. The hose is intended to be used to combat incipient fires above the floors and in pump rooms adjacent to the firerooms.

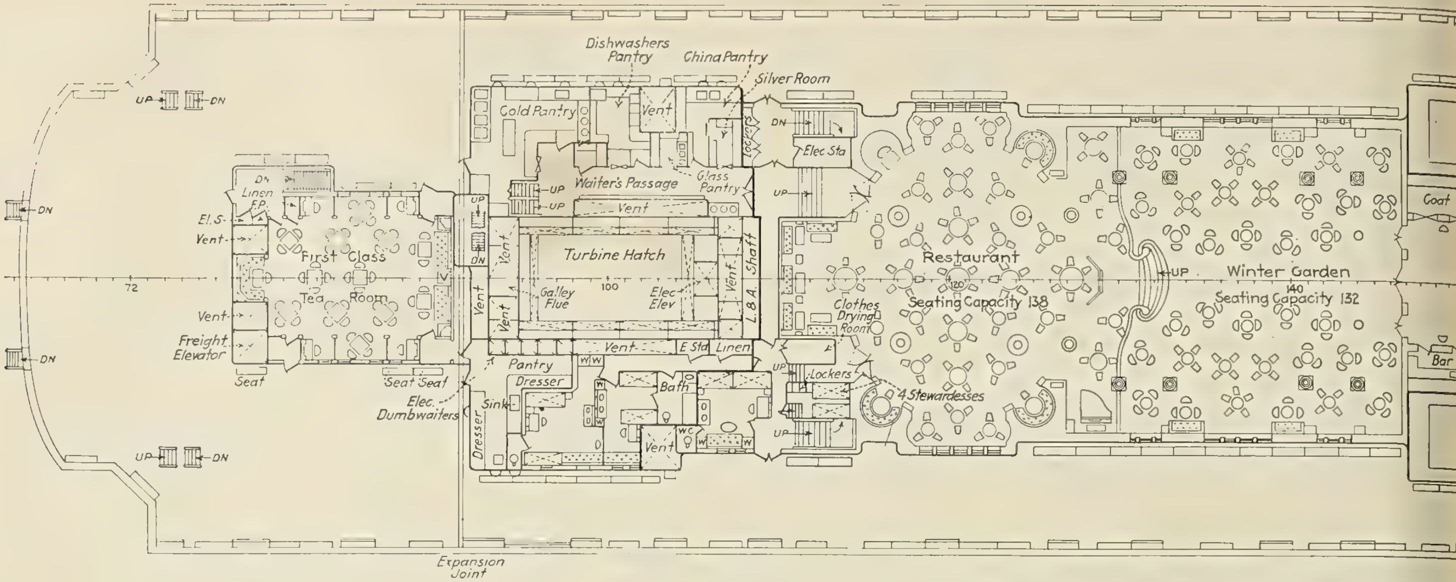
A rather unique method of controlling the various valves and pumping units has been devised. In each fireroom there are located special levers which control the valves supplying solutions to the distributors. Means are also provided in each adjacent fireroom so that, in case of fire, it will be possible to operate the system from an adjacent fireroom, or from the one affected. Separate controls are installed for all hose hydrants. A positive tripping mechanism is used on the control valves, which are operated in pairs on account of the two different liquids. When the tripping device is released, large coiled springs open the valves and eliminate undue strains on the control gear.

Simultaneously with the operation of any one of the controls, whether it is in one of the firerooms or filling stations, an electric contactor mounted on each pair of valves closes the circuit for the automatic magnetic lockout control panel and starts the electric motor driven pumping unit. The closing of this circuit also energizes the solenoid of a Cory electro-mechanical valve controlling the supply of steam to the turbine driven unit. Relief valves permit the solution to return to the respective tanks should the pressure build up above that for which the system has been designed. To provide against failure of the electric current aboard, the mechanical controls to all valves are so connected with the electro-mechanical steam valve that this valve is automatically opened and steam supplied to the turbine driven pumping unit whenever a control lever is operated.

Workmen Coming Off the Leviathan at the Noon Hour. Over 2,900 Men Are at Work on the Vessel Each Day

Heating and Ventilation

An entirely new steam heating system has been installed throughout the ship, designed and tested to withstand the full boiler pressure of 248 pounds per square inch, although the usual pressure carried in the system will not be over 30 pounds per square inch. The radiators, which are installed in all the public rooms and staterooms, with the exception of the steerage and crew's quarters forward, where the air supplied to the rooms is heated by a thermotank system, consist of copper coils designed and built by the Newport News Shipbuilding and Dry Dock Company. By making the steam heating system capable of withstanding full boiler pressure

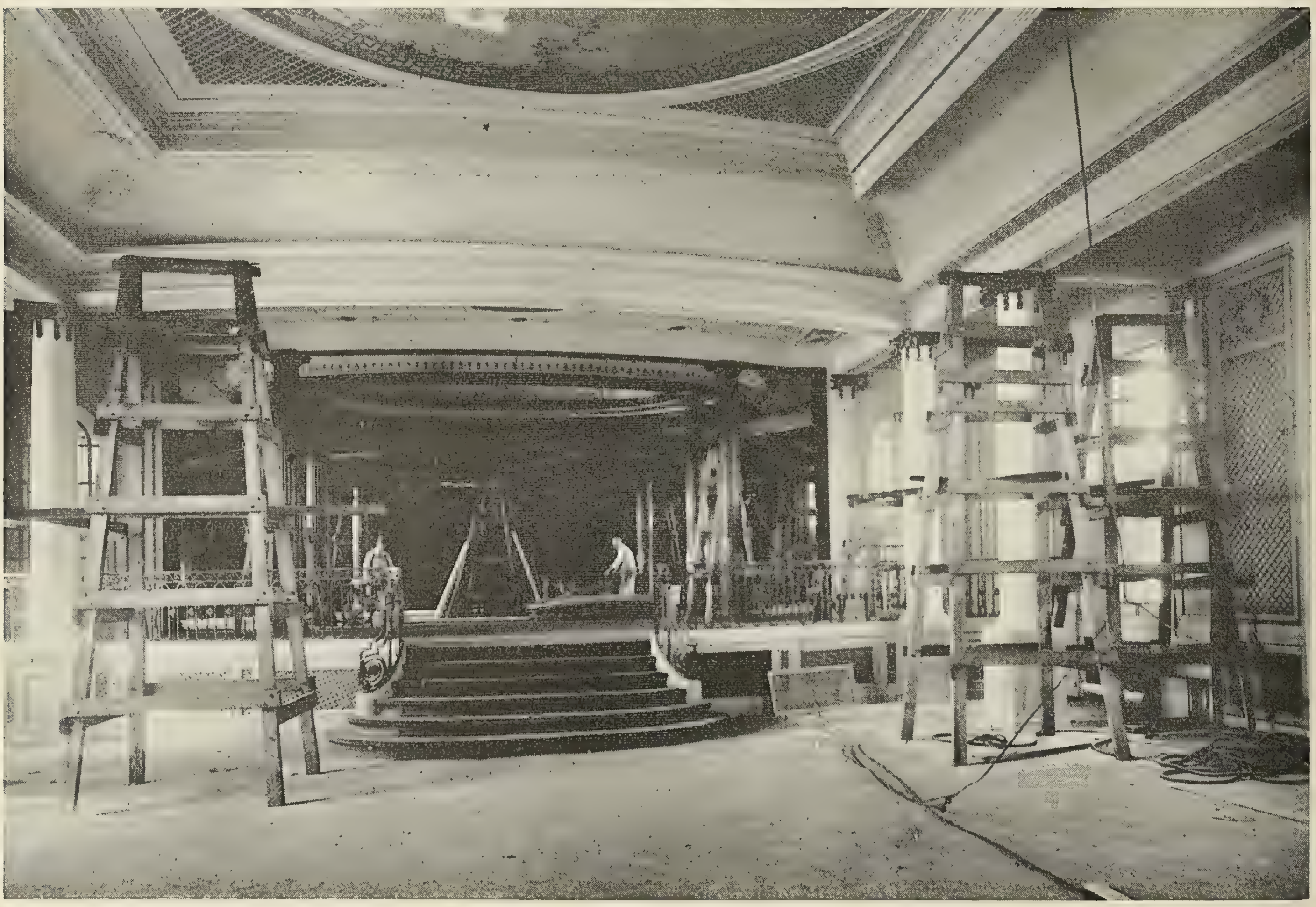


Plan of B Deck, Showing Arrangement of

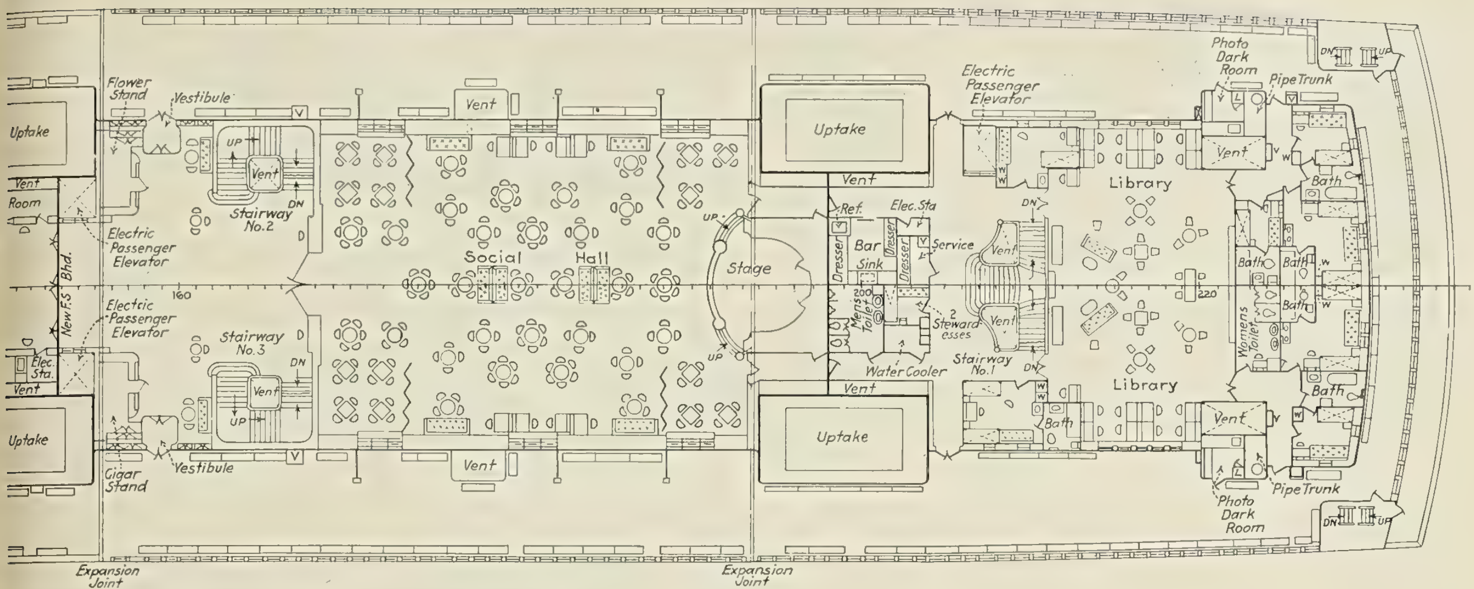
the vessel and passengers are safeguarded against damage or injury due to the possibility of full steam pressure ever being inadvertently admitted to the system.

Ventilation of the ship is accomplished by means of 124 separate ventilating systems, including 58 supply systems, 58 exhaust systems, six circulating fans for the refrigerating rooms and two propeller fans for the battery charging room. With the exception of the two propeller fans and eight blowers of 5,000 cubic feet per minute capacity each for the former coal bunker spaces on *H* deck which will be used for emergency passenger quarters, the ventilating fans, numbering 114, will consist of the old equipment originally installed but overhauled and placed in first-class working condition. The new fans are of the Sturtevant type.

All passenger and crew's quarters are being ventilated mechanically. In the steerage and crew's quarters the air



In the Winter Garden and Restaurant on B Deck the New Electric Wiring Is Complete and the Work of Decoration Is Under Way. The Panel at the Right, Consisting of Green Trellis Work on a Gray Panel With Gold Trim, Shows the General Scheme of Decoration for the Winter Garden

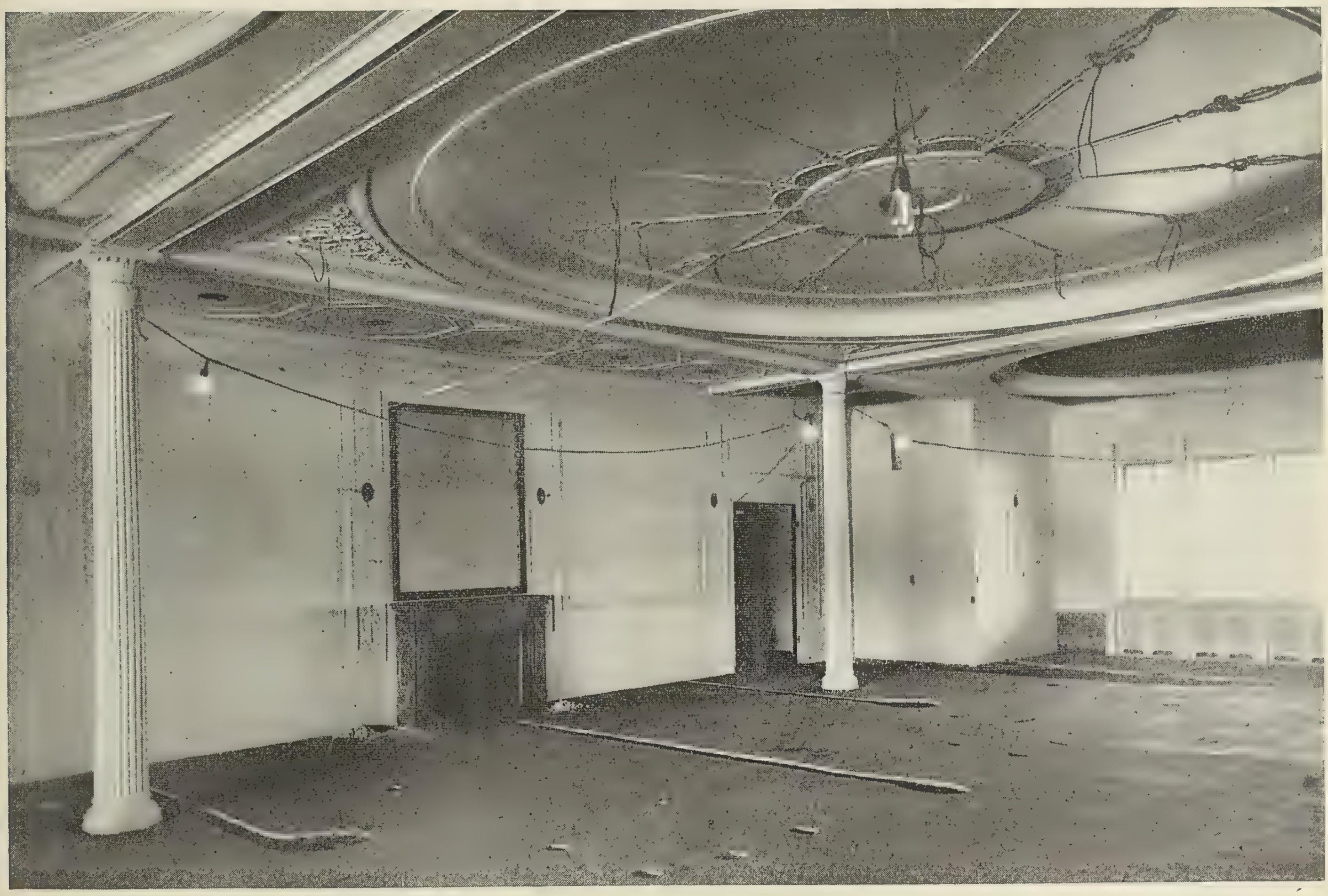


Principal First Class Public Rooms and Promenade

is heated by the thermotank system. Above *D* deck the ventilating ducts originally installed will in general be retained with slight changes. Delow *D* deck, where the accommodations are being entirely rebuilt, the ventilating system is completely rearranged.

Plumbing

All plumbing throughout the vessel has been removed and new plumbing of improved design installed. In all, about 55,000 feet of cold and hot fresh and salt water piping have been installed in the ship. For supplying the sanitary system six sanitary pumps are installed, three on each side of the ship in the engine room. The salt water supply is pumped through a 10-inch pipe to a 5-ton gravity tank located about 35 feet above the bridge deck in the after stack, which is a dummy located directly above the engine room hatch. In this



The Main Library on B Deck Is One of the Few Rooms on the Ship Comparatively Free from Scaffolding and Other Signs of the Activities of the Workmen. Here the Wiring and Ventilating Ducts Are Complete But the Floor, Ceiling and Walls Await the Finishing Touches

Section of the Joiner Shop in the Newport News Yard Where Much of the Furniture for the Leviathan Is Being Manufactured

position the tank gives ample gravity pressure all over the ship.

From this gravity tank a 12-inch supply pipe leads down to a point below *H* deck whence it runs fore and aft the full length of the engine and boiler rooms, supplying water to risers in three trunks.

The main feature of the sanitary system is the arrangement of the gravity tank, which is fitted with a slide valve operated by a float at the top of the supply pipe to the tank. This is so arranged that when water is drawn from the tank the float drops, opens the slide valve and admits water to the tank. When the valve opens the sanitary pump starts and keeps pumping water into the tank until the valve is closed by the lift of the float.

The pressure in the supply pipe from the pump to the tank is always kept at 150 pounds per square inch and is regulated by a governor valve fitted on the steam line to the pump. A diaphragm in the governor valve is connected to the supply line to the gravity tank so that, when the slide valve in the gravity tank opens and the pressure in the pipe falls slightly, steam is admitted to the pump and the pump starts, maintaining the pressure in the line close to 150 pounds per square inch. When the gravity tank is full and the slide valve closes, the pressure in the pipe rises slightly and shuts off steam to the pump.

The object of the slide valve and float in the gravity tank is to make it possible to keep a pressure of 150 pounds per square inch in the supply line so that the fire line can be taken from the same manifold and always have adequate pressure in the fire line system and at the same time have the sanitary supply from the gravity tank to the cold and hot water systems supplied by gravity without interruption.

Fresh water is distributed throughout the ship in a manner similar to that used for the salt water supply described above, except that the pressure in the supply pipe for the fresh water system is lower than that in the salt water supply pipe. In this case the gravity tank is also located in the dummy stack over the engine room hatch. The main supply pipes of the system run fore and aft below *H* deck the full length of the engine and boiler rooms. On *H* deck are located three salt water and three fresh water heaters, each with a capacity of about 20 tons per hour capable of heating the water from 40 to 140 degrees F. The heaters are especially designed so they can be taken apart and each part carried through the door of the compartment where they are installed.

Each section of the hot water system throughout the ship is fitted with a return pipe and a circulating pump located near the heater for the section on *H* deck. With this arrangement hot water is continuously circulating through the system, assuring a supply of hot water at all outlets at the instant a faucet is opened. "Sands" plumbing fixtures are used throughout the ship.

All of the heaters are interchangeable so that if for any reason one is out of commission the supply of hot water is not interrupted.

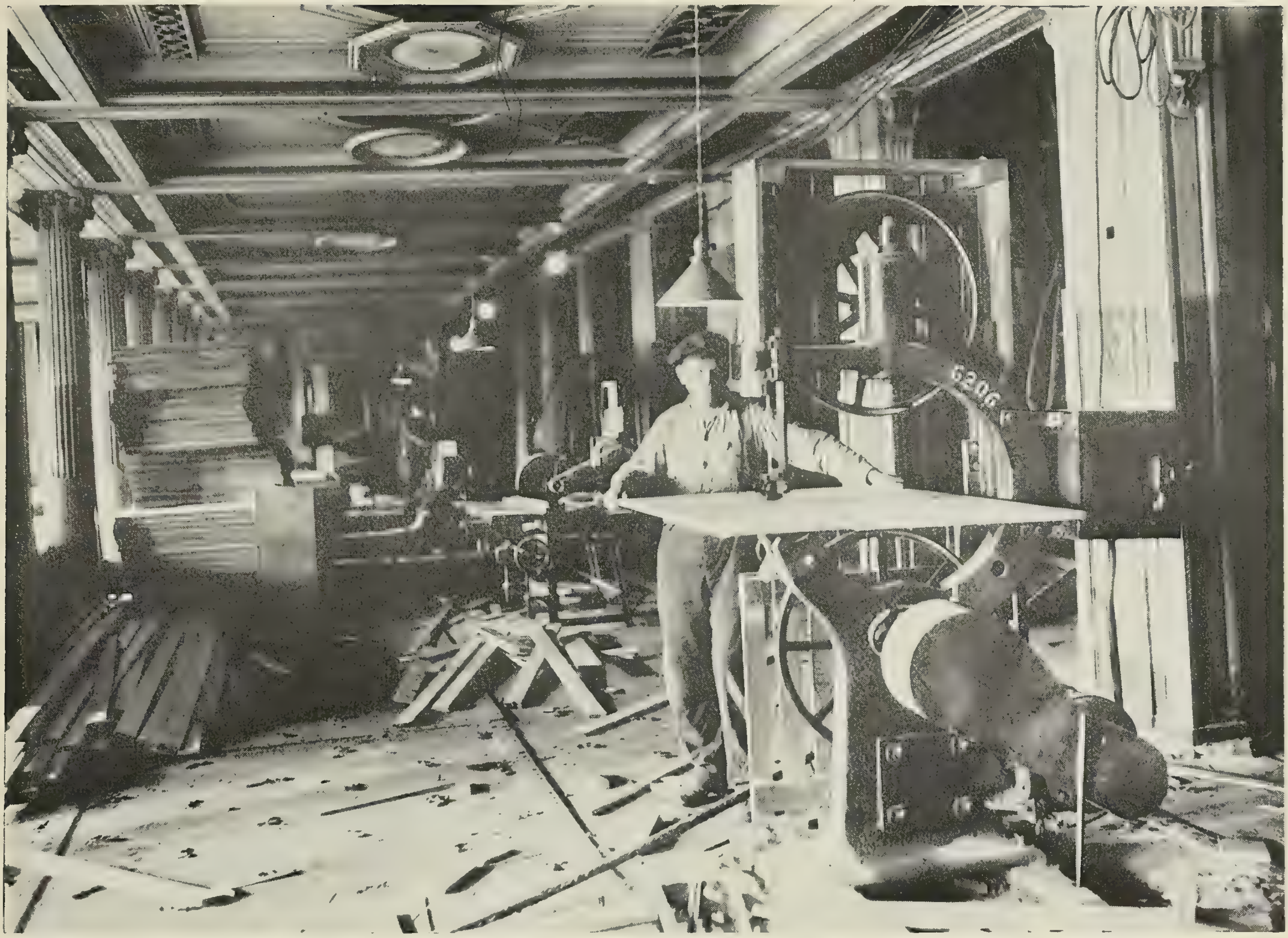
Piping for the hot and cold fresh water and cold salt water systems is of wrought iron while for the hot salt water system it is of copper. Iron pipes $1\frac{1}{4}$ inches and above are expanded into the flanges. In the copper piping the flanges are brazed on. All flanges up to 3 inches are of the hydraulic two-bolt type; above 3 inches the flanges are of the hydraulic type, round with four or more bolts.

Drainage System

All soil pipes, waste pipes from lavatories, floor drains, etc., leading from *G* deck overboard are fitted with a hydraulically operated emergency shut-off valve so that, if, from collision or other cause, one or more watertight compartments are flooded and the vessel sinks below *G* deck, all the valves can be instantly closed by turning a single handle in the engine

Restaurant Galley on A Deck. The New Ranges and Equipment Are Just Being Installed

View in Second Class Dining Room, Where Lit-O-Sil-O Flooring Has Just Been Laid



In the First Class Dining Room on F Deck Wood Working and Other Electrically Driven Machinery Has Been Temporarily Installed and the Room Has Become a Busy Workshop for the Finishing of Panels and Other Wood Work

room, thus preventing water from backing up through the plumbing fixtures and deck drains.

In general the drainage piping is the same as originally fitted in the vessel, except that slight rearrangements have been made to suit new arrangements of fixtures.

Electrical Plant

Electric current on the *Leviathan* is required for lighting over 15,000 electric lamps and for operating approximately 312 motors, ranging in size from 1/6 to 50 horsepower each and totaling 2,150 horsepower. The current is supplied by four 288-kilowatt turbo generating sets originally installed in the vessel and a new 500-kilowatt set supplied by the General Electric Company, Schenectady, N. Y. The new set is of the type which has proved so satisfactory in United States naval vessels and is guaranteed to operate in parallel with any or all of the retained German generating sets.

The generators supply direct current at 115 volts. The turbines of the retained sets are of the Parsons type made by Brown, Boveri & Cie. and are rated at 445 horsepower at 2,000 revolutions per minute. The generators are compound wound with 6 poles, were constructed by the Siemens, Schuckert Company, of Berlin, Germany, and are direct connected to the turbines.

Distribution

The dynamo room in which the current is generated is located in the hold between the propeller shafts, abaft the engine rooms. From the dynamo room the current is conducted to a main primary station on *G* deck, nearly overhead, and from there is distributed about the ship through numerous sub-stations.

When the *Leviathan* was built all of the electrical wiring was installed on the one wire system. In reconditioning the vessel the old wiring from sub-stations to outlets was entirely removed and complete new wiring of the latest navy type was fitted throughout the vessel. Up to the substations the one wire system is used but from the sub-stations to the outlets the two wire system is installed, except in a few cases where leads to some of the motors which were overhauled from the old equipment were retained. Both the wiring and fittings and all electrical equipment installed are designed to meet the most rigid underwriters' tests and inspections.

Special precautions have been taken to lessen fire risks and, as usual in reconstruction work, many interesting engineering problems have been encountered.

Switchboard

The original switchboard on the *Leviathan* was fitted with selective switches so arranged that the generators could not operate in parallel, *i.e.*, each set was assigned to some division of the load. This has been replaced by a new switchboard of the latest type so arranged that the generators run in parallel and pool their loads, which are distributed as required to the various systems. By this arrangement the plant can be operated more economically.

In the main primary station on *G* deck the subdivisions of load are made by grouping circuits at the panels. For lighting they are divided into groups such as general, police gangway, police cabin, etc., and also for festoon and prome-

nade circuits. For power they are divided into groups such as ventilating sets, boat motors, elevators, etc.

Lighting

From the main primary station on *G* deck the circuits are carried to sub-stations where enclosed, dead front panels are installed, fitted with double pole switches, and equipped with N. E. C. fuses. From this point to the lights the circuits are installed on the two wire system.

The fixtures in the public rooms and passenger quarters, supplied by the Sterling Bronze Company, are very elaborate and are especially designed for the locations. In the working part of the ship watertight fixtures are used throughout. Approximately 15,000 electric lamps will be installed, exclusive of festoon lamps and the like which will be provided for decorating the vessel on special occasions.

Wiring

Leaded and armored conductors are used in all places subject to dampness and in all working parts of the ship. In the passenger accommodations armored conductors are used and every precaution is taken in their installation to lessen fire risk, such as the provision of special outlet boxes at fixtures, kick pipes at the decks, guards to prevent injury of conductors and the like.

Electrical Power System

The electric power system comprises ventilating sets for the supply of forced ventilation to all parts of the vessel, electric ranges, elevators, an elaborate system of winches for handling lifeboats and the like, moving picture equipment, etc.

Emergency Lighting

In addition to the above, and wholly separate from it, is an emergency lighting and power system supplied by two 60 kilowatt General Electric generators driven by direct connected Worthington Diesel engines. The emergency sets are located well aft to avoid noise in the staterooms and on *E* deck well above the waterline.

In connection with the emergency system an automatic switching arrangement is provided so that, if the current supply should fail, due to the main generators becoming inoperative for any reason, the emergency circuits would automatically be shifted to current supply, first from an emergency storage battery and then to current from one or both of the emergency generators. The capacity of the emergency generators is sufficient to light all parts of the ship essential for operation, the exit of passengers to lifeboats, the lowering of the boats and the operation of the wireless and other signalling systems.

As a further precaution the switching system is divided to automatically provide separate emergency service for the machinery spaces and other working parts of the ship. All lifeboat lighting is controlled by one switch from the bridge and special features are included such as twelve 500 watt lights for illumination oversides when launching lifeboats.

Interior Communication

All the latest devices for interior communication, signaling, recording, etc., are provided. These systems are controlled from a room on *E* deck well above the waterline. Current is supplied from two motor generators, each with a 17 horsepower 110 volt direct current motor, a 3.75 K. V. A., 112 volt, 50 cycle, single phase alternating current generator and a 7.6 kilowatt 26 volt direct current generator. For emergency use there is a 26 volt storage battery which may be connected to the desired circuits upon failure of the motor generators.

The emergency storage batteries are liberal in capacity and are in duplicate. They are so arranged that one battery must always be connected for operation and only then is the other available for charging, so that after it is charged it can be thrown in prior to the exhaustion of the other battery.

The various interior communication and signalling systems will be briefly referred to under their respective names, in the following:

Searchlights.—One 36-inch high power searchlight, supplied by the Sperry Gyroscope Company, Brooklyn, N. Y., and embodying all the latest developments will be installed and there will be two portable 12-inch incandescent searchlights for use in docking the vessel, picking up buoys, and similar operations.

Telephones.—The ship's service telephone system extends to all parts of the vessel, including each first class stateroom. In all, over 600 telephones are connected to the central station, which consists of a two position lamp type Western Electric Company switchboard. In addition there are the usual telephone systems for the operation of the ship, including the following: Fire and engine room loud speaking system; loud speaking maneuvering circuit, between 14 operating stations; local circuit between ship's officers' quarters.

Fire Alarms.—For protection against fire two systems are employed, one pneumatic and the other manual; both of which are new.

The pneumatic system (Aero fire alarm) functions on the principle of a rising temperature in the compartment or stateroom covered causing an increase of pressure of the air in a small copper tubing which is run through the staterooms and compartments. There are approximately 300 circuits of this tubing, terminating at 26 section panels.

The vessel is divided into twelve sections, panels being located at approximately the center of each section where possible. By means of an annunciator drop these panels indicate which circuit in that section has operated and also transmit the panel section and deck location to the fire watchman's station.

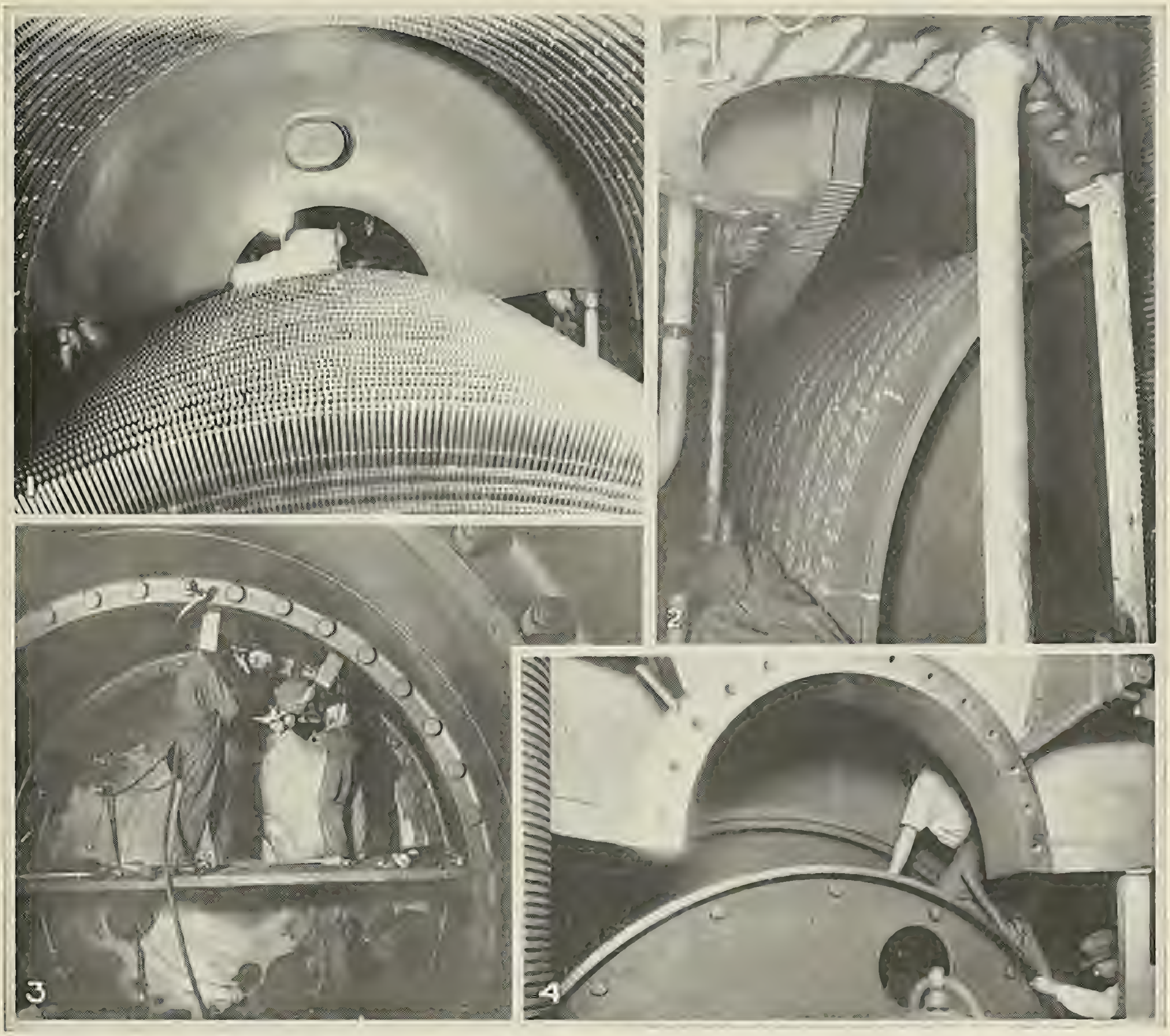
The manual fire alarm system consists of 45 alarm boxes from which an alarm can be sent in to the watchman's station. Electrical supervision is constantly maintained over both systems which announces the instant a circuit is broken or other trouble develops.

Watertight Door Alarm.—The watertight doors operated from the bridge, of which there are about 60, are equipped with contact makers which indicate on a diagram board on the bridge the position of each door. Alarm bells are located near each door, which are rung prior to the movement of the door. This alarm system forms a part of the hydraulic door control apparatus and prevents doors being operated without warning.

Clocks.—Electric clocks located in various public rooms and in many of the first class staterooms and suites are operated and controlled from the bridge. They can be simultaneously reset in either direction from the bridge as time changes occur during the trip. The control of the clocks is arranged on four circuits, there being an average of 35 clocks on each circuit.

Annunciator System.—An elaborate annunciator system covers the first and second class sections of the ship. Steward and stewardess buttons when operated in the various staterooms cause a lamp signal to operate at the nearest service station, giving the room number and class of service desired. This signal remains set until answered at the door of the stateroom from which the call was sent. At this point a reset button, operated by the steward or stewardess answering the call, releases the signal and restores the system to a condition ready for future calls.

About 80 of these section annunciators are installed, each covering ten rooms and being located centrally in the sections which they serve. The cases of the annunciators are of ornamental brass in a design which harmonizes with the surrounding joiner work. Additional annunciator systems are



Overhauling Main Turbines of the Leviathan: (1) Blading of Low Pressure Turbine; (2) Upper Casing of Low Pressure Turbine Raised, Showing Rotor; (3) Interior of Low Pressure Rotor; (4) Inspecting One of the Turbines

installed for the smoking rooms, swimming pool and bridge deck officers' quarters.

Bridge Equipment.—The apparatus on the bridge for the navigation and operation of the ship is as complete and modern as the science of shipbuilding can make it and covers engine telegraphs, installed in duplicate, revolution indicators, docking and anchor telegraphs, steering and rudder telegraph systems, whistle systems, iceberg danger signal system, submarine signal system and a life buoy system.

Sperry gyro compasses are installed in duplicate, with repeaters located at steering stations. A recorder is also installed for making a permanent record of all courses taken while under way.

Engine Room Equipment.—In the engine room are a number of special electrical signaling and recording systems all indicating at one central point. In this way the salinity of the feed water and the temperature of the fuel oil are indicated. A tableau board indicating the position of the various valves used to control the turbines is also installed and means are provided for transmitting the shaft speed from each of the four turbines to the boiler rooms, the engineers' log room and to the bridge.

Changes to Forced Draft System

The air supply to the after engine room is being doubled, with changes in the ventilating machinery and ducts. The duct to the forward engine room is divided, being made watertight to *F* deck and of light construction to the bridge deck, where two electrically driven multivane fans of 60,000 cubic feet of free air per minute are installed. The ventilation of the main galley is also being rearranged.

Steward's Department

With a full complement of passengers and crew the *Leviathan* will carry a total of 4,499 persons on her regular voyages.

To prepare the food for the restaurant, first class dining room, second and third class passengers, steerage, officers and crew there are seven complete galleys and four bakeries and the service of each is taken care of in a separate pantry. Each galley has its own storerooms, butcher shop and other facilities.

Galleys and Pantries

In design, arrangement and equipment the galleys and pantries will enable the operators of the vessel to offer to

ocean travelers a service superior to anything hitherto attempted afloat and unrivaled in any of the finest hotels ashore. Waste and labor will be cut down by the general adoption of electrically driven machinery in all the galleys and pantries and modern methods of administration will insure economical and efficient service in hot or cold climates.

Some idea of the extent to which modern electrically driven machinery is supplanting manual labor in these modern galleys and pantries is shown by the following equipment, supplied by the S. B. Sexton Company, Baltimore, Md., which is to be installed:

Restaurant Galley (on *A* deck, serving restaurant, winter garden, tea room and officers' dining room).—Six ranges, 1 bake oven, 2 grills, 1 ice cream maker, 1 meat and vegetable chopper, 1 bacon slicer, 1 potato peeler, 1 griddle, 1 waffle iron, 1 bread slicer, 1 coffee mill, 1 pastry mixer, 1 dishwashing machine (capacity 3,000 dishes per hour), 1 automatic toaster, all electrically operated.

First Class Galley (on *F* deck).—Two 8-fire island ranges, one 2-fire single range, 2 meat and vegetable choppers, 1 high powered mixer and whisking machine, 2 large capacity potato peelers, 4 60-gallon kettles, 12 2-section heavy duty vegetable steamers.

First Class Pantry (on *F* deck).—Six 20-gallon urns, 4 electric toasters, 1 electric coffee grinder, 2 electric dishwashing machines (each with a capacity of 15,000 dishes per hour), 1 double combination silver burnishing machine, electric bread slicers, griddles, ice cutting machine and knife cleaning machine.

In the first class dining saloon there are 48 electric plate warmers and in the restaurant 18 plate warmers.

Looking Aft from the Leviathan's Bridge, Starboard Side, Showing Material Being Placed on the Boat Deck by the 120-Ton Hammer Head Crane on the Fitting Out Pier Alongside

First Class Bread Making and Baking Rooms (2 on *F* deck).—Two heavy duty electric dough mixers (each of 2 barrels capacity), 2 electric ovens (each with a capacity of 180 one-pound loaves), roll dividing machine capable of producing 36 rolls at one operation, each roll of identical weight to the fraction of an ounce.

Pastry Room (on *F* deck).—One electric ice cream maker, 1 electric pastry mixer and whisking machine, 1 electric pie crust roller (capacity 25 crusts per minute), 1 electric griddle, 1 waffle iron (capacity 36 at one operation), 1 electric oven (capacity 60 one-pound loaves per hour).

Butcher Shop (on *F* deck).—Latest type, heavy duty electric meat chopper; electric bacon slicer and ice shaver.

Second Class Galley (on *F* deck).—One 6-fire range, four 50-gallon steam kettles, two 2-section vegetable steamers, 58-foot steam press and bainmarie.

Second Class Pantry (on *F* deck).—Three 20-gallon urns, electric toaster, griddle, coffee grinder, knife cleaning machine and dishwashing machine (capacity 15,000 dishes per hour).

Third Class Galley (on *E* deck).—One 4-fire island range, three 50-gallon kettles, one 800-pound capacity vegetable steamer, 1 heavy duty electric potato peeler, 1 electric vegetable and meat chopper.

Third Class Pantry (on *E* deck).—One electric dishwashing machine (capacity 6,000 dishes per hour), bread slicer, coffee grinder, knife cleaner, six 20-gallon coffee urns, 33-foot hot press and bainmarie.

Steerage Galley (on *D* deck).—One 3-fire, single front, coke-burning range, three 50-gallon kettles, one 800-pound capacity vegetable table steamer, electric heavy duty potato peeler.

Steerage Bakery (on *D* deck).—One latest type, 2-barrel capacity electric dough mixer, 1 heavy duty electric oven (capacity 180 one-pound loaves at one baking), two 20-gallon kettles.

Steerage Pantry (on *F* deck).—Three 30-gallon urns, electric bread slicer, coffee grinder and dishwashing machine (capacity 6,000 dishes per hour). An electric elevator connects the pantry with the galley three decks above.

Petty Officers' Galley (on *D* deck).—Special range, vegetable steamer, coffee boilers, electric coffee grinder.

Refrigerators

In addition to the main storage refrigerators on *J* deck for the preservation of perishable stores there are 20 service refrigerators distributed throughout the ship for the economical preservation of the proper foods at the required temperatures for the various classes of passengers. Twelve large refrigerators are for the first, second and third class passengers, while there are six others for restaurant supplies. To localize food for the crew and steerage passengers, four service refrigerators are installed forward on *D* deck and one on *E* deck. An ice-making plant, with a capacity of 6,720 pounds per 24 hours, is located on *H* deck. For easy handling the ice is made in 24-pound blocks and is sent from *H* to *F* decks by a special elevator. All new refrigerating apparatus is supplied by the Brunswick-Kroeschell Company, New Brunswick, N. J.

In order to facilitate serving passengers in the public rooms pantries have been constructed and fitted with all equipment necessary adjacent to the main social hall, winter garden, smoking room and tea room. For the convenience of passengers 43 ice water fountains supplied from brine cooled scuttle butts are distributed throughout the ship.

All pantries, service rooms, galleys and storerooms

throughout the ship are connected to the chief steward's office by telephones.

Steward's Supplies and Equipment

Supplies and equipment for the steward's department costing about $600,000 are being furnished by Gimbel Brothers, New York, in accordance with a contract awarded to this firm by the Shipping Board through its agents, Gibbs Brothers, Inc., New York. In all cases the equipment is the finest that can be procured and some idea of its quantity can be gained from the following items:

The linen for the first class dining saloon and restaurant and the sheets and pillow cases for the first class quarters is manufactured by McCrum, Watson and Mercer, Ltd., Milford, Ireland, and H. Matier and Company, Ltd., Belfast, Ireland, comprising about one-half of the linen required for the ship.

The linen for the second and third class passengers is manufactured by Hay and Robertson, Ltd., Dunfermline, Scotland, and H. Matier and Company, Ltd., Belfast, Ireland.

The silverware, supplied by the R. Wallace and Sons Manufacturing Company, Wallingford, Conn., totals more than 71,798 pieces of flat and hollow ware.

The china for the various dining rooms, manufactured by the Onondaga Pottery Company, Syracuse, N. Y., totals 102,000 separate pieces. The tea service sets for the restaurant and first class dining room are manufactured by Lenox, Inc., Trenton, N. J., making a grand total of 119,278 pieces of china.

The glassware, manufactured by the United States Glass Company, Pittsburgh, Pa., totals 48,084 pieces.

The equipment for the galleys and pantries, supplied by the Bramhall, Deane Company, New York, totals 23,000 pieces.

Other equipment, such as cotton sheets and pillow cases, steamer rugs, towels, etc., is being supplied in corresponding quantities by various manufacturers to the order of Gimbel Brothers.

Fresh Water Tanks

The fresh water is carried in the double bottom tanks and the former fresh water tanks aft of frame 150, including the two sections of the aft peak tank. In addition, two new fresh water deep tanks have been built aft. The boiler feed tanks have a total capacity of about 1,078 tons and the washing water tanks a capacity of about 1,667 tons. Two new vertical duplex pumps, 5¼ by 5 by 5 inches, have been installed for the drinking water system.

Ballast System

The former ballast system is being changed to provide a system for pumping ballast from all compartments used for the storage of oil fuel forward of frame 152 entirely independent of the oil handling, bilge or fresh water systems. The former ballast pumps are retained and one of the former ash ejector pumps has been connected to the ballast system.

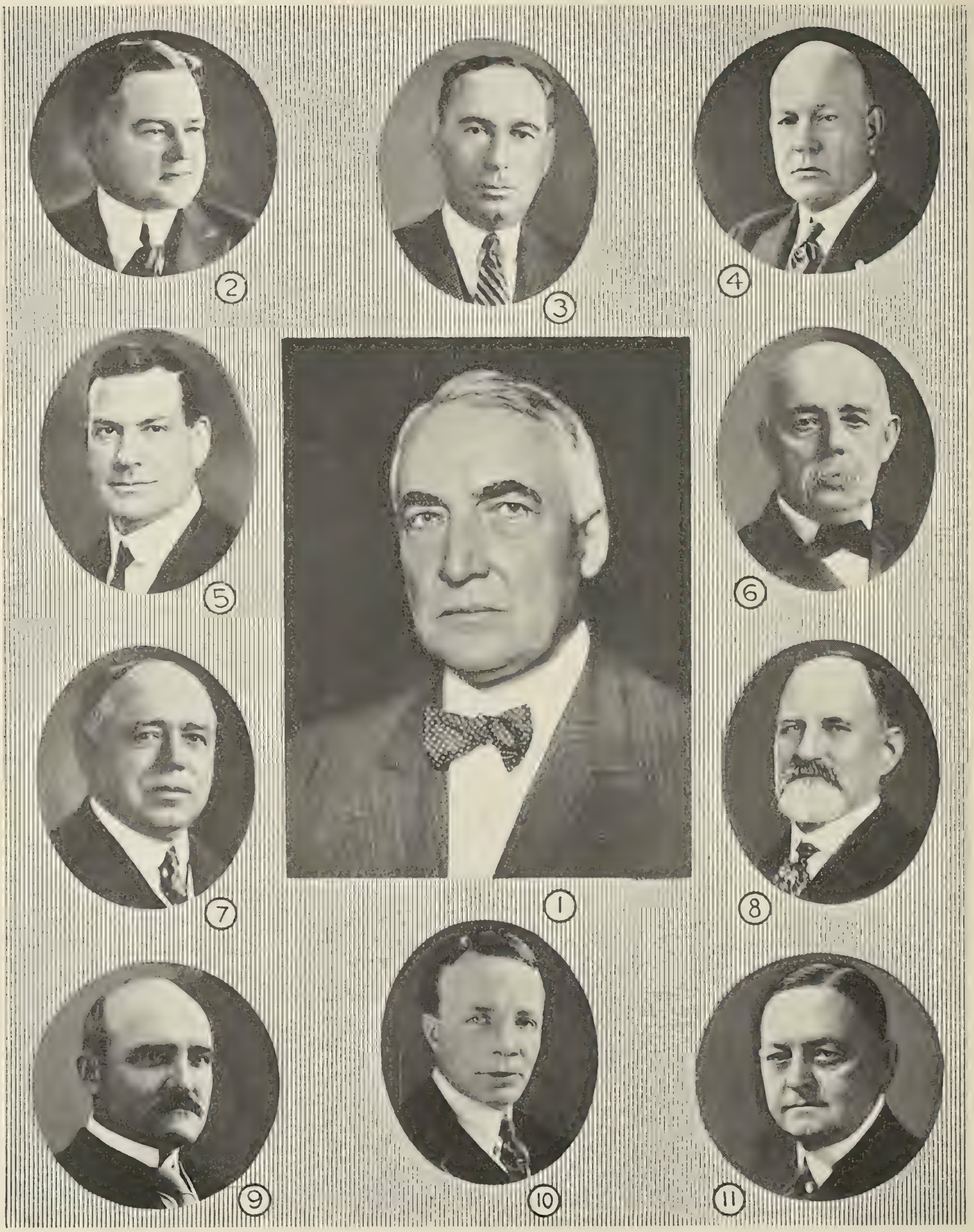
Lifeboats

The lifeboat equipment of the *Leviathan* will have a capacity for 4,750 persons. In all 76 lifeboats will be carried of which 40 with a total capacity for 2,466 persons will be reconditioned from the former equipment of the vessel.

Of the new lifeboat equipment, which is supplied by the American Balsa Company, Inc., Long Island City, N. Y., 22 are 30-foot metallic lifeboats, each with a capacity for 76 persons; 2 are 26-foot metallic lifeboats, each with a capacity for 50 persons; 3 are 30-foot metallic pontoons, each with a capacity for 66 to 70 persons, and 5 are 28-foot metallic pontoons, each with a capacity for 58 persons. In addition there are two 30-foot wooden motor lifeboats, built by the Newport News Shipbuilding and Dry Dock Company from plans supplied by the American Balsa Company, Inc., and equipped with engines by the Standard Motor Construction Company, Jersey City, N. J., and two 22-foot work boats. The motor lifeboats will be fitted with powerful wireless equipment and will be used for towing or conveying the other lifeboats.

The lifeboats will be handled by Welin quadrant davits of improved design with Welin electric lifeboat winches, and will be fitted with Mills releasing gear and Welin non-toppling blocks.

As the Leviathan Looked When She Left New York for Newport News for Her Transformation from a Troop Ship Into the Finest Passenger Liner Afloat



President, Statesmen of Both Parties, and Government Officials Who Are Leading Advocates for an American Merchant Marine

(1) Warren G. Harding, President of the United States; (2) Herbert Hoover, Secretary of Commerce; (3) Albert D. Lasker, Chairman of the Shipping Board; (4) Edwin Denby, Secretary of the Navy; (5) Senator Wesley L. Jones, Chairman of Committee on Commerce; (6) Congressman William S. Greene, Chairman of Committee on Merchant Marine and Fisheries; (7) Congressman George W. Edmonds, Vice-Chairman of Committee on Merchant Marine and Fisheries; (8) Senator Joseph E. Ransdell, President of National Merchant Marine Association; (9) Senator William M. Calder, Member of Committee on Commerce; (10) Colonel Theodore Roosevelt, Assistant Secretary of the Navy; (11) Senator Oscar W. Underwood, Democratic Leader of the Senate.

Officers of the American Marine Association

(1) Colonel E. A. Simmons, *Marine Engineering and Shipping Age,* president; (2) W. M. Wampler, The Ellcon Company and Coen Company, Inc., vice-president; (3) Robert B. Lea, Sperry Gyroscope Company, secretary; (4) H. C. Davis, Row and Davis, Engineers, Inc., treasurer.

Big Program Prepared for American Marine Week

Marine Exposition at Grand Central Palace Larger Than Ever—Naval Architects and Marine Engineers Convene November 8-9

THE second American Marine Week with its Marine Exposition, the thirtieth annual convention of the Society of Naval Architects and Marine Engineers and the meeting and participation of eighteen maritime organizations will be held at the Grand Central Palace, Lexington avenue and 46th street, New York City, during the week of November 4-11. This will be the greatest co-operative maritime event that has ever been staged in this country and it is bound to attract the attention of the entire nation to the necessity for an American merchant marine.

President Warren G. Harding will send a message which will be delivered in person by Honorable Edwin Denby, Secretary of the Navy, at the annual banquet of the Society of Naval Architects and Marine Engineers, which will take place at the Waldorf-Astoria on the evening of November 9. The President, as is well known, is heart and soul in favor of a strong American merchant marine, adequate in size to carry the greater portion of our commerce and to serve as a naval auxiliary in time of war or in a national emergency.

A fair idea of the quantity and quality of the exhibits at the Marine Exposition may be obtained by a perusal of the Directory of Exhibits which is published on pages 691 to 695 of this issue. The United States Coast Guard turbo-electric drive cutter *Modoc* will be open for inspection at the United American Lines pier 86, North River, at the foot of 46th street, from November 4 to 9, inclusive.

Program of "American Marine Week"

Saturday, November 4

OPENING DAY

4:00 P. M. Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

8:00 P. M. Formal opening of "Second Annual Marine Exposition" and "AMERICAN MARINE WEEK" under the auspices of the American Marine Association.

8:05 P. M. Address by Colonel E. A. Simmons, president, American Marine Association.

8:15 P. M. Address by Colonel Theodore Roosevelt, Assistant Secretary of the Navy.

9:00 P. M. Band Concert.

10:30 P. M. Closing Hour.

Monday, November 6

SHIP OWNERS' DAY

12:30 P. M. Public opening hour.
Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

2:00 P. M. Regular quarterly meeting, American Steamship Owners' Association, in association office, 11 Broadway, New York.

3:30 P. M. *"Ship Radio,"* by Arthur Batcheller, Chief Radio Inspector, Second District, Department of Commerce.

4:00 P. M. Official inspection of Marine Exposition, by the Technical Committee, American Steamship Owners' Association, William F. Gibbs, chairman.

NAVY NIGHT

8:30 P. M. *"The Navy,"* by Rear Admiral C. T. Vogelgesang, U. S. N.

9:00 P. M. Concert by Brooklyn Navy Yard Band.

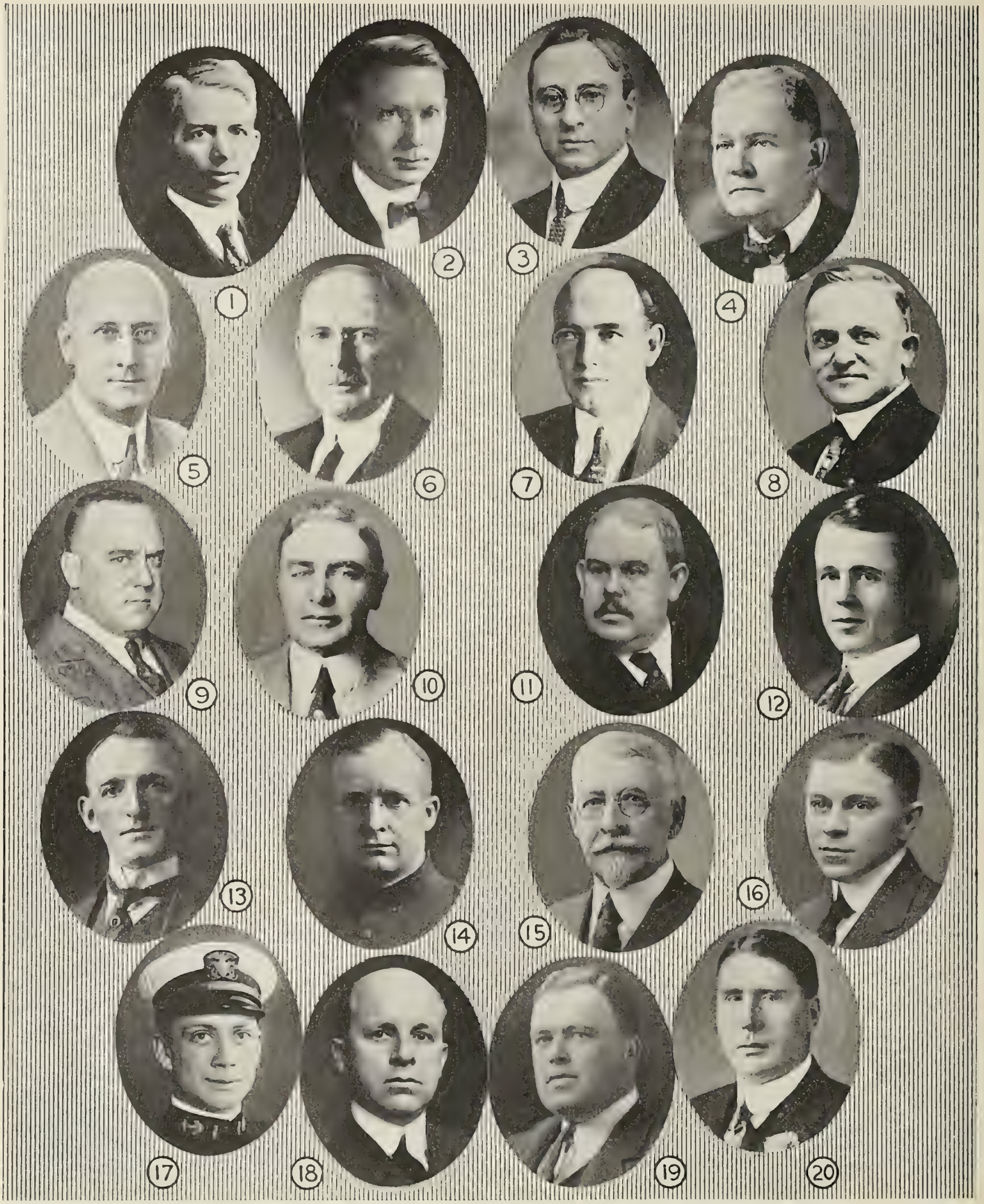
10:30 P. M. Closing Hour.

Tuesday, November 7

NEW YORK TOW BOAT EXCHANGE DAY

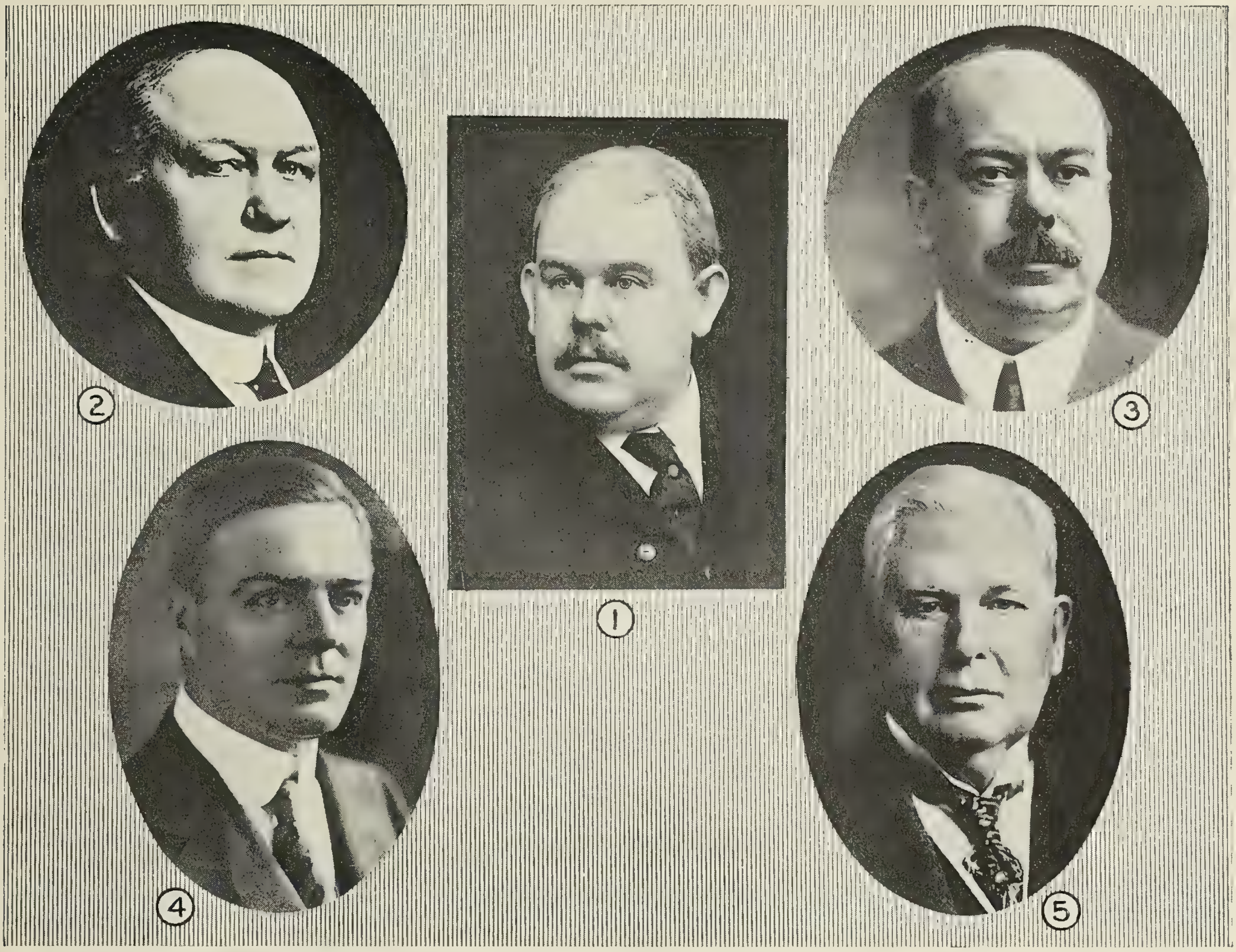
12:30 P. M. Public Opening Hour.
Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

2:30 P. M. Moving Picture, *"Tow Boating in New York*



Directors and Chairmen of Committees of American Marine Association

(1) H. L. Hibbard, Cutler-Hammer Manufacturing Company, executive committee; (2) W. A. Cather, Worthington Pump and Machinery Corporation, chairman, publicity committee; (3) M. L. Katzenstein, Worthington Pump and Machinery Corporation, executive committee; (4) Capt. W. H. Stayton, Baltimore Steamship Company, executive committee; (5) H. W. Adams, Jr., Scovill Manufacturing Company, executive committee; (6) W. P. Smith, William Cramp and Sons Ship and Engine Building Company, executive committee; (7) F. C. Bradbury, Crane Company, executive committee; (8) J. C. McQuiston, Westinghouse Electric and Manufacturing Company, executive committee; (9) Frank Hatch, Shephard Electric Crane and Hoist Company, executive committee; (10) Gardner Cornett, Pneumercator Company, executive committee; (11) W. M. McFarland, Babcock and Wilcox Company, executive committee; (12) G. W. Selby, Marine Decking and Supply Company, executive committee; (13) H. C. Davis, Row and Davis Engineers, Inc.,executive committee; (14) J. Hense, Northern Fire Apparatus Company, chairman, transportation committee; (15) W. A. Lake, Pantasote Company, chairman, entertainment committee; (16) K. W. Heinrich, Bethlehem Shipbuilding Corporation, executive committee; (17) W. S. Doxey, *Marine Review*, chairman, enrollment committee; (18) C. F. Scott, General Electric Company, executive committee; (19) Benjamin F. Neilds, Jr., National Malleable Castings Company, chairman, liaison committee; (20) H. F. Alexander, Pacific Steamship Company, executive committee.



(1) Captain Walter M. McFarland, President, Society of Naval Architects and Marine Engineers; (2) H. H. Raymond, President, American Steamship Owners' Association; (3) Charles H. Potter, President, Maritime Association of the Port of New York; (4) James L. Ackerson, President, Atlantic Coast Shipbuilders' Association; (5) Stevenson Taylor, President, American Bureau of Shipping.

Harbor," specially filmed for The New York Tow Boat Exchange, Auditorium, second floor, Exposition Hall.

3:00 P. M. Meeting of the Council of the Society of Naval Architects and Marine Engineers, Room 1101, Engineering Societies' Building, 29 West 39th street, New York, N. Y.

Ocean Officers' Night

8:00 to 10:30 P. M. National election returns broadcasted at 412 meters, by the Anacostia, D. C., station.

8:00 P. M. Smoker for masters, mates, pilots, engineers and radio telegraphers under the auspices of Ocean Officers' Conference, Auditorium, second floor, Exposition Hall.

10:30 P. M. Closing Hour.

Wednesday, November 8

Naval Architects' and Marine Engineers' Day

9:00 A. M. Private opening hour for members of the Society of Naval Architects and Marine Engineers.

10:00 A. M. Opening Technical Session of the Society of Naval Architects and Marine Engineers, President W. M. McFarland, presiding, Auditorium, second floor, Exposition Hall.

The following is the list of papers to be read and discussed at the Wednesday meetings:

1. *"Automatic Steering,"* by Elmer A. Sperry, Member.
2. *"Details of Naval Design from Jutland,"* by Commander Herbert S. Howard, C. C., U. S. N., Member.
3. *"The Application of Dyson's Method to Propellers of Ocean-going Merchant Vessels,"* by Edwin A. Stevens, Jr., Member.
4. *"Stresses on Vessels of the Great Lakes Due to Waves of Varying Lengths and Heights,"* by Professor Herbert C. Sadler, Member of Council, and Professor Anders Lindblad, Member.
5. *"A Study of the Wake of Certain Models by Means of a Current Meter,"* by Professor Edward M. Bragg, Member.
6. *"Some Experiments on Propeller Position and Propulsive Efficiency,"* by Rear Admiral David W. Taylor, C. C., U. S. N., Honorary Vice-President.

12:30 P. M. Public Opening Hour.
Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

Shipping Board Night

8:30 to 9:30 P. M. Concert, by the Washington Navy Yard Band, broadcasted at 412 meters, by the Anacostia, D. C., station.

9:35 P. M. *"The Navy After the Limitation of Arms Conference,"* by Captain Luke McNamee, U.S.N.; broadcasted at 412 meters, by the Anacostia, D. C., station.

10:30 P. M. Closing Hour.

Thursday, November 9

Naval Architects' and Marine Engineers' Day

9:00 A. M. Private opening hour for members of the Society of Naval Architects and Marine Engineers.

10:00 A. M. Second Day Technical Sessions of the Society of Naval Architects and Marine Engineers, President W. M. McFarland, presiding, Auditorium, second floor, Exposition Hall.

The following is the list of papers to be read and discussed at the Thursday meetings:

7. *"Efficiency in the Operation of Steamships,"* by Captain Daniel A. J. Sullivan.
8. *"A Sixteen Hundred and Fifty Horsepower Gasoline Fire Boat,"* by Arthur D. Stevens.
9. *"The Longitudinal Strength of Rigid Airships,"* by Professor William Hovgaard.
10. *"Machinery and Trials of the Passenger Ships—American Legion Class,"* by Robert Warriner, Member.
11. *"Standardization as Affecting the Shipbuilding Industry in the United States,"* by Ernest H. Rigg, Member of Council.
12. *"The Selection of the Best Kind of Propelling Machinery,"* by James L. Ackerson, Member.

12:30 P. M. Public Opening Hour.

Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

7:00 P. M. Reception at Waldorf-Astoria, 34th street and Fifth avenue, New York, N. Y., for members and guests of the Society of Naval Architects and Marine Engineers.

7:30 P. M. *"Ship Radio,"* by Arthur Batcheller, Chief Radio Inspector, Second District.

8:00 P. M. President Warren G. Harding's Message, delivered by The Hon. Edwin H. Denby, secretary of the Navy, at banquet of the Society of Naval Architects and Marine Engineers.

8:30 P. M. Address by Admiral R. E. Coontz, Chief of Naval Operations, U. S. N., broadcasted at 412 meters, by the Anacostia, D. C., station.

9:05 P. M. *"Navy Personnel,"* by Rear Admiral Thomas Washington, Chief of the Bureau of Navigation, U. S. N., broadcasted at 412 meters, by the Anacostia, D. C., station.

10:30 P. M. Closing Hour.

Friday, November 10

Department of Commerce Day

10:00 A. M. Annual meeting and election of officers of the American Marine Association, Auditorium, second floor, Exposition Hall.

Order of Business:

1. Reading of minutes of preceding meeting.
2. Report of Executive Committee.
3. General business.
4. Reports from district meetings of elections of members to Executive Committee.
5. Election of officers.

11:30 A. M. "Informal Conference on Standardization of Shipbuilding Equipment," under the auspices of the American Marine Association and The Department of Commerce, Auditorium, second floor, Exposition Hall.

12:30 P. M. Public Opening Hour.

2:30 P. M. Maritime Conference, Auditorium, second floor, Exposition Hall.

Speakers:

1. *"Duties of the Coast Guard,"* by Commander B. L. Reed, U. S. C. G.
2. *"The Lighthouse System of New York Harbor and the U. S. Coast Line, and Recent Improvements,"* by Geo. R. Putnam, Commissioner of Lighthouses, Department of Commerce. Illustrated by moving pictures.
3. *"The Relation of the Merchant Marine to Business,"* by Francis H. Sisson, Vice-President, Guaranty Trust Company.
4. *"Fuel Economy in Shipping Board Vessels,"* by Commander R. D. Gatewood, Director Division of Maintenance and Repair, United States Shipping Board.

National Merchant Marine Association Night

8:00 P. M. *"The Merchant Marine as a National Defense,"* by Captain William H. Stayton, President, Baltimore Steamship Company, Speakers' Forum, Exposition Hall.

8:30 to 9:30 P. M. Concert, by the Washington Navy Yard Band, broadcasted at 412 meters, by the Anacostia, D. C., station.

8:30 P. M. Motion picture, *"Tow Boating in New York Harbor,"* specially filmed for the New York Tow Boat Exchange, Auditorium, second floor, Exposition Hall.

9:35 P. M. *"What the Navy Does for Your Business and What It Costs You,"* by Captain L. M. Overstreet, U. S. N., broadcasted at 412 meters, by the Anacostia, D. C., station.

10:30 P. M. Closing Hour.

Saturday, November 11

Maritime Association Day

12:30 P. M. Public Opening Hour.

2:30 P. M. Maritime Conference, Auditorium, second floor, Exposition Hall.

1. *"The Value of the Tramp Steamship,"* by Chas. H. Potter, President, Maritime Association of the Port of New York.
2. Address, by Winthrop L. Marvin, Vice-President and General Manager, American Steamship Owners' Association.
3. *"The Ocean Officers,"* by Captain John F. Milliken, Secretary-Treasurer, Neptune Association.
4. *"Efficiency of Personnel,"* by Captain Reginald Fay, President, National Board Steam Navigation.

Armistice Night

8:30 P. M. *"Engineering and the Navy,"* by Rear Admiral J. K. Robison, Engineer-in-Chief, U. S. N., broadcasted at 412 meters, by Anacostia, D. C., station.

9:00 P. M. *"The Naval Air Service,"* by Rear Admiral William A. Moffett, Chief of the Bureau of Aeronautics, U. S. N., broadcasted at 412 meters, by Anacostia, D. C., station.

10:30 P. M. Closing Hour.

Directory of Exhibits at the Marine Exposition

Adams and Westlake Company, Philadelphia, Pa.—Joiner hardware, drapery hardware, furniture hardware, parcel racks, book racks, notice plates, sash locks, deck storm windows, electric fixtures for general superstructure lighting, including ceiling, wall and berth lights. Representatives: E. L. Langworthy, E. H. Stearns, C. S. Heller, H. Seip. Booth 75-A.

The Admiral Line, 17 State Street, New York.—Large outline map of the United States on which will be shown five trans-Continental railroad routes to the Pacific coast featuring the Admiral Line passenger service between Seattle, Victoria, Portland, San Francisco, Los Angeles and San Diego; in conjunction with the United States Shipping Board will present the Admiral Line trans-Pacific passenger service between Seattle and Victoria and Yokohama, Kobe, Shanghai, Hong Kong and Manila. Representatives, H. W. Rose, R. A. Wabraushek, A. C. Jones. Booth 311.

American Balsa Company, Inc., 305 Vernon Avenue, Long Island City, N. Y.—Ten-foot by 35-foot section of a ship's deck upon which is installed a set of Welin quadrant davits; a 26-foot steel nesting type lifeboat of the 1A class and a 26-foot steel standard 1A lifeboat chocked and nested between the davits as on board ship; Mills lifeboat releasing gear; Welin non-toppling blocks; Welin electric power winch. Representatives: H. F. Sailor, J. D. Andrew, Lewis Tanning. Booth 92.

American Car and Foundry Company, 165 Broadway, New York.—No. 3 two-electrode Berwick electric rivet heater; No. 3 one-electrode type "E" Berwick heater; 4-foot Berwick rod heater. Representatives: F. C. Cheston, W. M. Earl, J. S. Helt, D. B. Wallace. Booth 49-A.

American Engineering Company, Philadelphia, Pa.—Electric gypsy windlass. Representative: P. E. Kelly. Booth 89-B.

American Manganese Bronze Company, Homesburg, Pa.—A large bronze propeller blade; a medium sized solid propeller wheel of bronze polished; a demonstration of the ductility of the company's bronze as compared with iron and steel; test charts and photographs of installations of propeller wheels. Representatives: T. H. Addie, M. C. R. Spare, Mr. Nelson. Booth 2.

American Society of Marine Designers, 29 West 39th Street, New York.—Will represent the National Society at the Marine Show. Representative: C. C. Jacobson. Booths 228 and 229.

American Steel Foundries, McCormick Building, Chicago, Ill.—Models and photographs of standard types of ship's anchors, together with some views of specially interesting marine steel castings recently produced. A novel and successful improvement in the stockless anchor will also be shown. Representatives: A. Trevor Jones and J. T. Rowbottom. Booth 19.

Asbestolith Manufacturing Company, 1 Madison Avenue, New York.—Asbestolish for flooring, base, wainscoting, stair covering, etc., and for superior ship decking. Representatives: R. C. Burnside and assistants. Booth 64.

The Ashton Valve Company, 161-179 First Street, Cambridge 41, Boston, Mass.—Pop safety valves and relief valves; pressure and vacuum indicating and recording gages as well as testing outfits for gages and boiler test pumps; large steam whistles. Representatives: C. W. Buckelew, C. W. Ulrick and C. D. Motheral. Booth 21.

The Babcock & Wilcox Company, 85 Liberty Street, New York.—Full size sectional model of 4-inch merchant marine boiler; various sections of boiler parts, valves, fittings and tools; mechanical oil burners in full size mounted models; concentration indicator in operation. Representatives: J. H. King, C. W. Middleton, A. Ross Mackay, George H. Daniels, T. B. Stillman, John Coleman, E. A. Colson. Booth 42.

Beaver Tile Corporation, 442 West 42nd Street, New York.—Cork composition tile; natural cork tile for passages, lobbies, public rooms and staterooms. Representatives: Messrs. Newell, Hendrickson and Nason. Booth 43.

Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa.—Bethlehem-Weir turbo feed pump; Bethlehem-Weir reciprocating pump; complete Bethlehem (Dahl) mechanical oil burning system, including pumps, heaters, etc. Representatives: G. E. Lawrence, F. K. Steinrock, G. W. Grove, A. E. Fraser, G. H. Dillon, A. V. Reynolds. Booth 70.

Bramhall Deane Company, 261 West 36th Street, New York.—Representative: W. F. Wright. Booth 77-B.

Briggs Engineering Works, 227 24th Street, Brooklyn, N. Y.—Complete oil firing equipment. Representatives: C. N. Wheeler, H. W. Kuppinger. Booth 103.

Brunswick-Kroeschell Company, New Brunswick, N. J.—Two-ton refrigerating capacity marine type Brunswick ammonia compressor, direct connected to steam engine; ½-ton refrigerating capacity marine type Brunswick ammonia compressor, direct connected to steam engine; 2-ton refrigerating capacity marine type Kroeschell carbonic anhydride compressor, direct connected to steam engine; 1-ton refrigerating capacity marine type Brunswick ammonia compressor, direct connected to 3 horsepower electric motor; small Brunswick ammonia compressor cut down to show interior construction. Representatives: W. O. Whitney, W. Carpender, Booth 34.

Chase Metal Works, Waterbury, Conn.—Samples of all the sizes of copper tubing furnished to the S. S. *Leviathan*; Admiralty condenser tubes; Chamet bronze; brass rod; tubing, wire and sheet; a Balopticon which will explain by photographs and titles the Chase processes of making condenser tubes; new book on condenser tubes explaining their manufacture and specifications. Representatives: R. Chase, Capt. Gleason, D. K. Crampton, C. B. Smith, J. F. Giffen. Booth 90-A.

Coen Company, 50 Church Street, New York.—Oil burning equipment completely piped up ready for operation; firing fronts, including a forced draft Scotch boiler front, also a new large air register front for natural or induced draft; easy cleanable oil heaters; duplex oil strainers both for oil suction, discharge and for Diesel engine work; steam atomized burners with furnace decking for a flat flame burner, also the "Safety First" lighting torch; Type "A" burner complete with holder. Representatives: W. M. Wampler, F. Hall, H. B. Chamberlain, F. S. Harper. Booth 57.

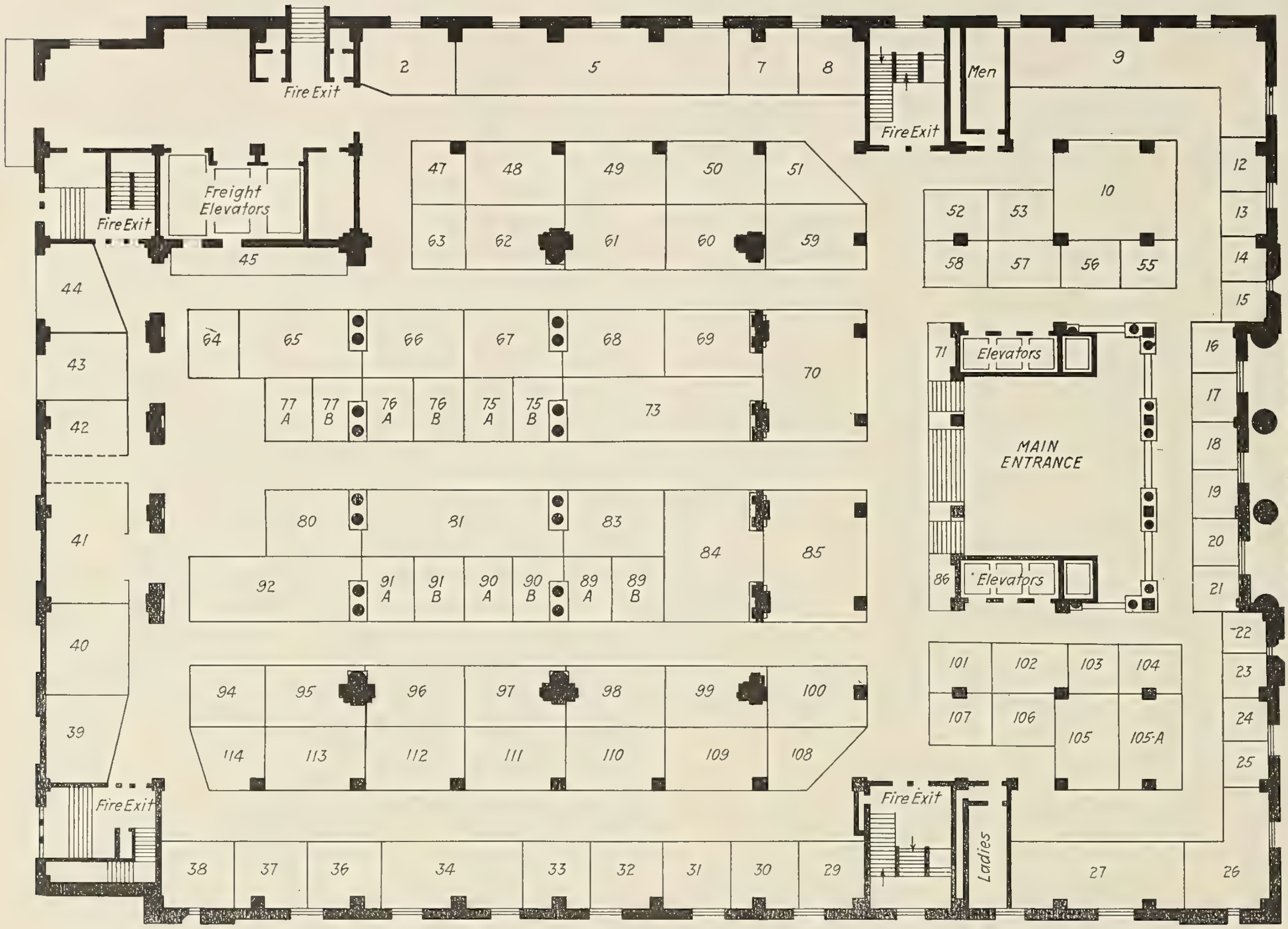
Jas. A. Coffey Engineering Corporation, 1416 Broadway, New York.—Asphalt floors for interior and exterior decking; asphalt calking putty. Representatives: J. A. Coffey, L. Coffey, Miss Adele Eckstein. Booth 25.

The William Cramp & Sons Ship & Engine Building Company, Richmond and Norris Streets, Philadelphia, Pa.—A large Parsons' manganese bronze propeller, 11 feet 4 inches diameter, weighing about 12,000 pounds, this wheel being machined complete including the planing of the driving faces of the blades to a true helical surface and designed to transmit about 23,000 horsepower; complete model of the steamship *Santa Paula;* half size model of a lifeboat fitted with the Hunt releasing device; ingots of Parsons' manganese bronze, Parsons' white brass and Cramp's Diesel engine babbitt; Parsons' manganese bronze welding rods, Cramp's aluminum solder and Cramp's cast iron solder; spiral gear wheels of Cramp's super-strength bronze for Diesel engines; framed photographs of Cramp's marine Diesel engines, Burmeister & Wain type. Representatives: Courtland D. Cramp, I. B. Ashenfelter, W. P. Smith, Carroll S. Smith, C. R. Peterson and J. C. Shaw. Booth 73.

Crandall Engineering Company, 100 Border Street, East Boston, Mass.—Demonstration model of a longitudinally-trussed floating dock and a working model of the Crandall railway dry dock together with photographs of dry docks now in operation. Representatives: R. H. Lindgren and J. Stuart Crandall. Booth 38.

Crane Company, 836 South Michigan Avenue, Chicago, Ill.—The largest brass gate valve made. Representatives: G. E. Barker, E. Morgenthal, T. H. Ireland, J. C. Cole, F. C. Bradbury. Booth 68.

Crane Packing Company, 59 Park Place, New York.—"John Crane" flexible metallic packings, superheat packings, metal-



Main Floor Plan of Marine Exposition, Grand Central Palace, Lexington Avenue and 46th Street, New York

lic condenser packing. Representatives: J. N. Walton, E. M. Roberts, C. W. Bryden. Booth 304.

Department of Commerce, Washington, D. C.—*Foreign and Domestic Commerce*: Maps showing trend of foreign trade, etc., books, monographs, charts and other publications on foreign trade; posters. Representatives: R. E. Hutchinson, E. G. Gregg.

Bureau of Standards—The principal exhibit of the Bureau of Standards will be that of radio equipment, which will give an excellent example of the Bureau's development work. The Bureau will also exhibit its fog signal model and a collection of publications of direct concern to maritime interests.

Lighthouse Service: Flashing lens, illuminating and revolving, as in service; fog signal automatic siren and horn; lens lantern; post lantern; electric clock and flasher; lighthouse Service pennant; radio fog signal system; radio compass for use with radio fog signal; radio fog signal chart; charts of New York harbor. Representatives: J. T. Yates and assistants.

Bureau of Navigation—A complete ship radio installation, Kolster decremeter and other instruments used in connection with the inspection of radio stations, and the omnigraph used in connection with the examining of operators; if possible, arrangements will be made to examine applicants for radio licenses at the booth; if not, Mr. Arthur Batcheller, Radio Inspector, who will be in charge of the exhibit, will arrange for the examination of applicants at the Custom House, New York. Representative: W. D. Terrell.

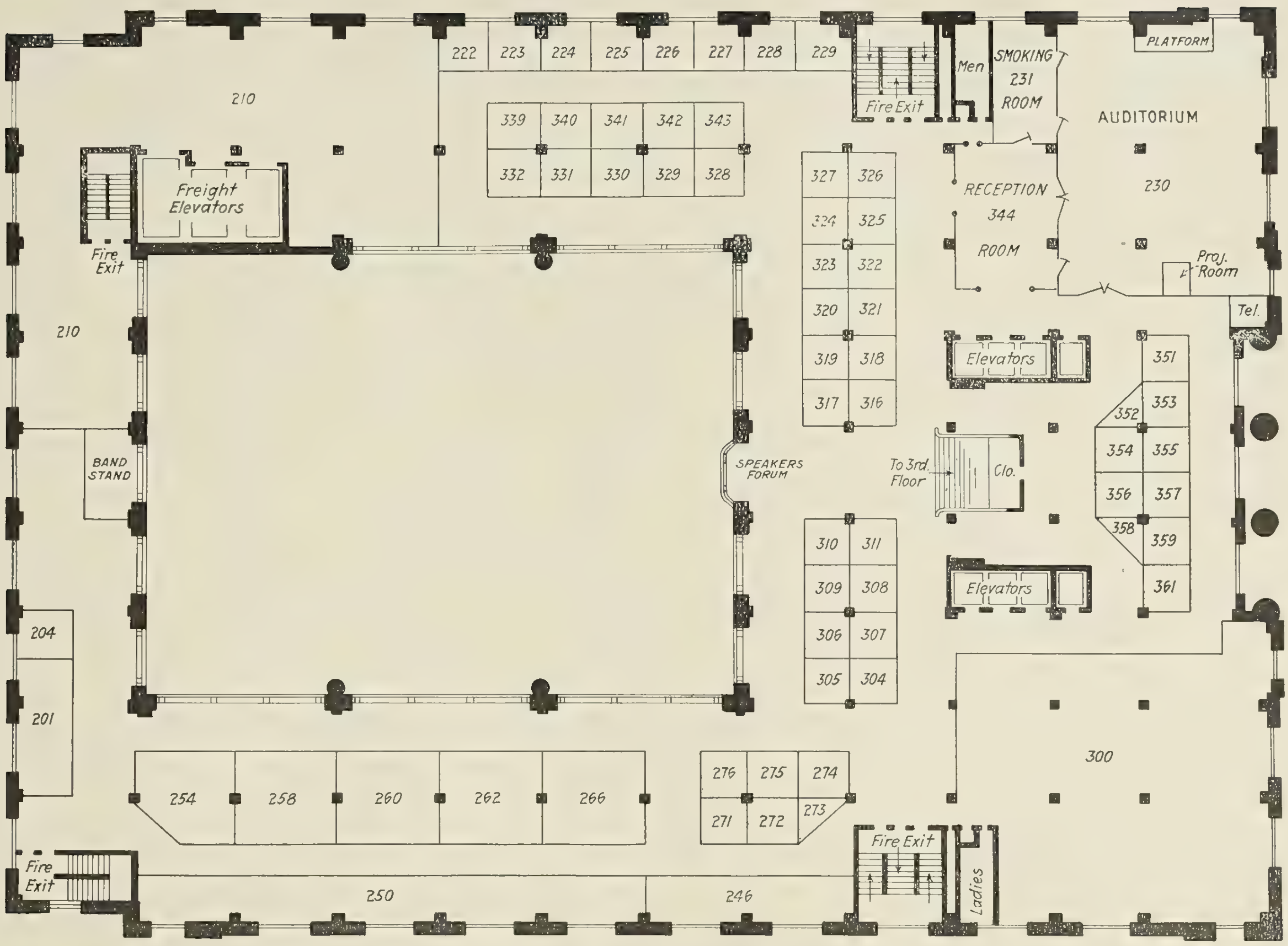
Coast and Geodetic Survey—A complete set of charts, over 600 in number, covering the territorial waters of the Atlantic, Pacific and Gulf coasts of the United States, Porto Rico, Hawaii, Panama, Virgin Islands, Guam and the Philippines, a total length of shore-line in excess of 100,000 miles; fifteen volumes of sailing directions, or coast pilots, for all the coastal and inside routes covered by the coast survey charts, "Tide and Current Tables," for all navigable tidal waters and for all currents in territorial waters; special publications on miscellaneous subjects related to navigation; diagrams and photographs illustrating methods and results of the survey's operations. Representative: R. L. Faris.

Steamboat Inspection Service: Shoulder line carrying gun with full equipment; twenty-two-foot lifeboat with full equipment for ocean service; set of turning out davits for lifeboat; model of Engelhardt lifeboat; model of catamaran life raft; model of Carley life float; adult life preserver for ocean service; adult life preserver for river and harbor service; child life preserver; life preserver in section; line carrying gun with full equipment; cork ring buoy with water light; ring buoy not covered; American fire tank containing liquid and buckets; soda and acid fire extinguisher; soda and acid fire extinguisher, sectional; deep sea sounding machine; section of hose with nozzle, gage and relief valve; dead weight gage tester; air pump and gage for testing air tanks of lifeboats; set of steel stamps for stamping boiler plate; micrometer for calipering boiler plate; set of steel test coupons; set of welding coupons; each of license forms; detecting and control cabinet for fire; safety valve, sectional; fog horn, mechanical; fusible plugs. Representative: F. P. Noel. Booth 210.

Diamond Power Specialty Corporation, Detroit, Mich.—Display of two new types of marine soot blowers, Model BBM for Scotch marine boilers and Model G-2 M for use with revolving soot blower elements on marine watertube boilers; working models of its Model B rear end blower for Scotch marine boilers and of its Model G-2 and Valve-in-Head soot blowers for watertube boilers. Representatives: L. W. Nones, A. W. Homan and Mr. Crawford of New York and Robert June of Detroit. Booth 63.

O. M. Edwards Company, Inc., Syracuse, N. Y.—Window balances, locks and anti-rattling devices for sash; interior steel furniture and trim. Representatives: E. F. Chaffee, Harold Edwards, J. J. Edwards, A. J. Horgan. Booth 56.

Ehret Magnesia Manufacturing Company, Valley Forge, Pa.—Ehret's 85 percent magnesia pipe and boiler coverings, 85 percent magnesia plastic, powdered magnesium carbonate. Representatives: R. F. Leonard, A. A. Pfeiffer, J. W. Quinn. Booth 75-B.



Mezzanine Floor Plan of Marine Exposition, Grand Central Palace, Lexington Avenue and 46th Street, New York

Electric Storage Battery Company, 18th and Allegheny Avenues, Philadelphia, Pa.—Exide batteries for marine service; wireless, lighting, gyroscope and compass service, motor boats and speed boats, and ignition; also Exide "Ironclad" batteries for industrial trucks and a complete submarine cell; complete marine wireless switchboard. Representatives: Mr. Folk, Mr. Gay, Mr. Fuller, Mr. Wright, Mr. Kulberg, and Mr. Norris. Booth 356.

The Ellcon Company, 50 Church Street, New York.—White porcelain enameled stanchions; Aero metal fittings; window curtains and fixtures for passenger vessels; ball bearing door hangers; flexible reinforced metal hose for oil burning vessels; ladder for engine and fireroom gratings fitted with safety step treads to prevent slipping. Representatives: W. M. Wampler, G. H. Ord, C. A. Koenig. Booth 53.

Exeter Machine Works, 30 Church Street, New York.—Rotary pumps suitable for the following marine service: Cargo, ballast, fuel oil transfer, lubricating oil, sanitary and fresh water. Representative: C. G. Holmquist. Booth 77-A.

Fire Detecting Wire Corporation, 2 West 45th Street, New York.—Automatic fire alarm apparatus. Representatives: C. Van Zandt, C. Peterson. Booth 276.

Foster Marine Boiler Corporation, 111 Broadway, New York.—Catalogs and test data describing the operation of the Foster marine boiler on over 135 ships; also literature describing the new Foster marine economizer which is the latest development in fuel conservation for marine boilers. Representatives: J. J. Nelis and John Kilfeather. Booth 106-A.

General Electric Company, Schenectady, N. Y.—The rotating element of a 3,000 horsepower reduction gear, less the low speed gear, such as is used in ships equipped with geared turbine drive; model of the low speed gear and an actual spring thrust bearing used in propulsion service; control panels built for the Golden Gate line of Diesel engine electric ferryboats and the turbine electric boats for the San Francisco-Oakland line in San Francisco harbor; motors for driving ship's auxiliary apparatus; 10 kilowatt steam engine driven generating set and control panel; searchlights; complete arc welding outfit in operation. Representatives: W. J. Day, E. K. Henley, C. H. Giroux, G. E. Young, W. J. Belanger. Booth 5.

Gimbel Brothers, 33rd Street, New York.—China, glass, silverware, linens, sheets, pillow cases, towels, blankets, steamer chairs, books and other items to be furnished under contract to the S. S. *Leviathan* Representatives: E. F. Quinn, J. J. Matthews, J. J. Lynch. Booth 83.

Griscom-Russell Company, 90 West Street, New York.—Reilly submerged type evaporator, self-scaling; G-R automatic feeder which maintains a constant water level in the evaporator shell; the G-R automatic vapor pressure control valve; the special G-R drainer for keeping the coils clear of water, as well as the other standard fittings; G-R type C expansion joint. Representatives: R. Colston and A. R. Hoffman. Booth 60.

Hooven-Owens-Rentschler Company, Hamilton, Ohio.—Hamilton Damara piston rings; marine engine parts; pictures of the various Hamilton marine engines; views of the plant and of ships driven by Hamilton marine engines. Representatives: G. A. Rentschler, Jr., H. Greger, H. A. Smith, F. L. Hummel. Booth 18.

Hyde Windlass Company, Bath, Maine.—Electric steering gear in operation; electric telemotor recently perfected. Representatives: R. E. Ross, F. L. Andrews, C. E. Paine. Booth 33.

International Nickel Company, 67 Wall Street, New York.—Monel metal and nickel in basic and commercial forms; power plant applications; various applications to marine uses. Representatives: G. A. Wotherspoon, E. A. Turner, A. Muller-Thyme. Booth 76-B.

Keasbey & Mattison Company, Ambler, Pa.—Working steam coil with various types of insulating materials applied and suitable instruments on these to show the actual cutting down in temperature by the use of these insulations; charts will show the actual saving in B. T. U. through the use of

the several grades of insulation. Representative: L. L. Barrett. Booth 47.

Kingsbury Machine Works, 4320 Lackawanna Street, Frankford, Philadelphia, Pa.—Kingsbury thrust bearings (six exhibits): self-lubricating bearings of two types; turbine bearings; large equalizing bearing; air-lubricated bearing; thrust shoe for United States airplane carrier (largest yet built). Representatives: A. Kingsbury, H. A. S. Howarth, W. T. Holman, Nelson Ogden. Booth 101.

Lee & Simmons, Inc., 44 Whitehall Street, New York.—Models of barges used in the transportation business in the port of New York; models and pictures showing the evolution from the old sail lighter to the barges of the present day. Representatives: D. T. Lamond, G. J. Lutz, R. O. Wilson, C. C. Miller, J. P. Heuer, W. G. Conners, H. F. Carls. Booth 31.

Leviathan Model.—Booths 81 and 82.

Luckenbach Steamship Company, 44 Whitehall Street, New York.—Representative: A. B. Townsend. Booth 316.

Lunkenheimer Company, Cincinnati, Ohio.—Valves, lubricators, oil cups, grease cups, whistles, boiler mountings and similar engineering specialties; the line of valves consists of one for practically any purpose and made of either bronze, iron, steel or a special alloy. Representatives: W. A. Reynolds, J. E. Cooper, H. Burger. Booth 99.

Marine Decking & Supply Company, 116 North Delaware Avenue, Philadelphia, Pa.—American Lit-O-Sil-O decking; American Lit-O-Sil-O flooring; Madesco tackle blocks, sheaves, shackles, etc. Representatives: W. L. Peebles, J. S. Tyler, E. P. Jewell and G. W. Selby. Booth 96.

Marine Engineering and Shipping Age, Woolworth Building, New York.—Marine Engineering and Shipping Age. *The Boiler Maker,* "Shipbuilding Cyclopedia," "Practical Marine Engineering," "Laying Out for Boiler Makers" and marine books. Representatives: Colonel E. A. Simmons, Henry Lee, C. R. Mills, R. V. Wright, George Slate, F. B. Webster, H. H. Brown, L. S. Blodgett, W. Z. Gardner, H. B. Bolander, J. A. Miller, B. L. Dombrowski, R. F. Duysters, N. C. B. Fowles, J. E. Anderson. Booth 51.

Marine Works, Inc., 31 Coenties Slip, New York.—Marine kitchen and pantry outfits; sundry labor saving machines for food service; crockery; glassware, etc. Representative H. Cunningham. Booth 204.

Maritime Association of the Port of New York, 78 Broad Street, New York.—Bureau of information from a direct wire from the Maritime Exchange, giving complete news of ship disasters, sailings, movements of vessels in New York harbor and principal ports in the world; reproduction of bulletin board used on the exchange, giving entrances and clearances from the port of New York; numerous ship models. Representative: H. J. Mostyn. Booth 225.

Mercantile Specialty Company, 11 Broadway, New York.—Smithson safety porthole, smoke indicator and fuel economizer; the Keesey bridge and engine telegraph. Representative: H. G. Mullen. Booths 306 and 307.

Munson Steamship Line, 67 Wall Street, New York.—Pictures, posters, literature and reproduction of the interior of a steamer. Booth on second floor with Shipping Board exhibit.

Mustor Manufacturing Company, Grand Central Terminal, New York.—Interlocking rubber tiling; corrugated and perforated rubber mats and matting; patented oval split core and flap ring packings; high pressure sheet packings; pump valves. Representatives: G. F. Mustor, Walter S. Mustor. Booth 46-A.

National Merchant Marine Association, Washington, D. C.—Literature published by the Association. Representatives: A. H. Battey, Mr. MacDonald. Booth 311.

The National Malleable Castings Company, Cleveland, O.—Various sizes of Naco chain, shackles, both connecting and anchor, and swivels. Representative: B. Nields, Jr. Booth 58.

National Meter Company, 229 Broadway, New York.—Oil and water meters, high, low and medium pressures, for all services. Representative: G. D. MacVeagh. Booth 77-B.

Natural Carbonic Gas Company, Newark, N. J.—Cylinders containing carbonic gas—CO_2, for refrigerating purposes. Representatives: T. P. Arnold, P. E. Fay and C. A. Nichols. Booth 305.

Nautical Gazette, 20 Vesey Street, New York.—*Nautical Gazette* and various shipping books. Representative:: J. F. Loe. Booth 350.

Newport News Shipbuilding & Dry Dock Company, Newport News, Va.—Pictures illustrating the development of the plant; model of the S. S. *Leviathan* which is being reconditioned by the Newport News Company is to be located in an adjacent booth. Representative: J. P. Kiesecker. Booth 80.

New Process Chemical Company, 114 Liberty Street, New York.—Marine glue; anti-corrosive paint; anti-fouling paint; canvas paint; copper paint; tri-bituma coatings; linoleum cement. Representatives: A. Schlueter, L. Strawser, W. Gutterson, M. E. Granier. Booth 342.

New York Journal of Commerce.—Representative: P. Moneypenny. Booth 310.

New York Marine News Company, 26 Water Street, New York.—*The Marine News.* Representatives: H. J. Harding, A. H. Addoms, H. Palmer, T. Olsen, G. Weiss, C. Files and G. F. Howell. Booth 86.

New York Tow Boat Exchange, 11 Moore Street, New York.—Will demonstrate facts about the towing industry; models of tow boats; a motion picture of the towing industry entitled "Full Speed Ahead." Representative: C. A. Mason. Booth 343.

New York Tribune.—Booth 317.

Northern Fire Apparatus Company, Minneapolis, Minn.—New cargo pumps; fuel oil service and transfer units demonstrated in operation, driven by well-known standard types of marine motors; illustrations of Northern rotary pumps on bilge, sanitary, fire-protection and fresh water duties in marine and shore service. Representative: J. A. Hense. Booth 55.

Pacific Mail Steamship Company.—Exhibit in conjunction with U. S. Shipping Board. Booth Oriental in decorations. Representative: J. P. Sutherland. Booth 266.

Pantasote Company, 11 Broadway, New York.—Vehisote standard panel board for all joiner work; Pantasote leather for seats, curtains and all upholstery; partial cabin showing construction of ceilings and bulkheads. Representative W. A. Lake. Booth 30.

Peabody Engineering Corporation, 110 East 42nd Street, New York.—Peabody-Fisher wide range mechanical burner; Peabody draft gage; standard burner and air register, so mounted as to show all connections and the method of attaching this register to the boiler front without the use of any special burner tile, using instead ordinary arch brick. Representatives: J. P. Leask, E. B. Sadtler, R. I. Condon, E. L. Delafield. Booth 15.

Penton Publishing Company, Cleveland, O.—*The Marine Review.* Representatives: A. O. Backert, R. V. Sawhill, W. S. Doxsey, F. V. Cole, Joseph Fuller, A. H. Jansson. Booth 32.

Pioneer Company, 25 Broad Street, New York.—Various types of metallic packing for steam engines in full size models. Representatives: G. Thiessen, G. W. Jenson, Mr. McDonough. Booth 273.

Pneumercator Company, 40 Flatbush Avenue, Brooklyn, N. Y.—Pneumercator tank gages, ship's draft gage, distant boiler gage glass (the latter, located in the engine room or chief's office will reproduce in full size the boiler gage glass enabling the officer on watch to know at all times the height of water in the boiler). Representatives: G. Cornett, H. S. Parks, W. Thomas. Booth 8.

Port of New York Publicity, 5 Beekman Street, New York. Representative: A. R. Arnheim. Booth 46.

Power Specialty Company, 11 Broadway, New York.—Foster superheater. Representatives: J. J. Nelis, John Kilfeather. Booth 106-B.

Roto Company, Hartford, Conn.—Tube cleaners for Scotch marine watertube and firetube boilers; condenser cleaning apparatus; plate and hand hole scrapers. Representatives: J. V. Doherty, W. R. Van Nortwick, W. M. Kelley. Booth 352.

Row & Davis Engineers, Inc., 90 West Street, New York.—Paracoil evaporator, feed water heater, oil heater, water still; RanD system for reliquefying bunker oil without steam coils in the double bottom tanks. Representatives: R. R. Row, H. C. Davis and Messrs. Thompson and W. Young. Booth 65.

Scovill Manufacturing Company, Waterbury, Conn.—Brass mill products and manufactured articles; seamless tubing, sheet metal, rods and wire made from brass, bronze and nickel silver besides a representative collection of manufactured articles; Scovill condenser tubing; numerous slides will illustrate how the Admiralty mixture condenser tubing is

made; exhibit of metallographic microscope and numerous specimens of metal; samples of corroded condenser tubing; Admiralty condenser tubing; booklet on tube manufacture. Representatives: Philip Davidson, E. L. Carter, C. A. Gleason, M. L. Sperry, Jr., L. L. Williams and E. H. Callanan. Booth 59.

Shipping, 82 Beaver Street, New York.—Representatives: John Collins, Peter Bain. Booth 358.

Sperry Gyroscope Company, Brooklyn, N. Y.—Gyro compass; helm angle indicator; ship stabilizer model; high intensity searchlight; "mechanical quartermaster" (simplified gyro compass). Representatives: R. B. Lea, Messrs. Whitaker, Conover, Jobson. Booths 22, 23 and 24.

The Stamford Foundry Company, 117-149 Canal Street, Stamford, Conn.—Shipmate ranges in various sizes; Oxo kerosene burner. Representative: F. W. Brant. Booth 327.

Sterling Cooper Corporation, 220 West 42nd Street, New York.—Sterling's Marine Catalog and other publications. Representatives: F. W. Sterling, T. G. Newbery, E. Zahn, G. P. Nightingale. Booth 71.

B. F. Sturtevant Company, Hyde Park, Boston, Mass.—Forced draft unit; 5 kilowatt gasolene engine generating set; steam turbine; electric driven ventilating sets; 75 horsepower gasolene propulsion engine. Representatives: E. B. Williams, E. L. Moran. Booth 111.

Submarine Signal Company, Boston 9, Mass.—Submarine pneumatic bell; Fessenden oscillator. Representatives: W. L. Gifford and E. P. Howe. Booth 326.

The Superheater Company, 17 East 42nd Street, New York.—Model of the Elesco fire-tube superheater as applied to the Scotch marine type of boiler; model of the Elesco superheater as applied to marine watertube boilers and boilers used on river boats; steam pyrometer for measuring steam temperatures; engineering data and literature. Representatives: H. B. Oatley, G. E. Ryder, C. A. Brandt, G. C. Fuller, W. H. Lovekin, G. E. Kershaw, W. McLintock, G. L. Moore, J. A. Barnes. Booth 66.

The Texas Company, 17 Battery Place, New York.—Lubricating oils and greases for every purpose aboard ship; fuel oils for bunkers and Diesel engines of all standard makes; literature on the use of oil-burning equipment will be distributed; other technical matter will deal with the lubrication of all primary and auxiliary units including reciprocating engines, turbines, Diesel engines, ice machines, dynamos and blower engines. Representatives: F. J. Shipman, D. Perry Quinn, J. L. Ward, L. O'Malley, E. A. Lobb, H. W. Schilling, R. A. Fischer and Al. St. James. Booth 16.

W. & J. Tiebout, 118 Chambers Street, New York.—Complete assortment of marine hardware and supplies. Representatives: John Tiebout, Sr., John Tiebout, Jr., G. V. Carlin, J. D. Gillespie, F. J. Morissey, C. H. Schult. Booth 29.

P. S. Thorsen & Company, Inc., 81 Coffee Street, Brooklyn, N. Y.—All types of insulation for steam and brine work and the best method of application. Representative: M. L. Bullard. Booth 107.

Todd Shipyards Corporation, 25 Broadway, New York.—Todd fuel oil burning systems for marine and stationary practice; Todd mechanical burner; steam atomizing burner; Todd "Guardian"; Todd thermofeed regulator; differential pump governor; Elesco firetube superheater and other steam saving specialties. Representatives: H. Nightingale, G. P. Haynes, R. Payne, R. Sterling, T. Torgensen, Jr. Booth 84.

Tuco Products Corporation, 30 Church Street, New York.—"Flexolith" composition flooring material shown in Pantasote Company's exhibit, Booth 30. Representatives: D. W. Pye, Walter Byrnes.

Underwood & Underwood, 6 East 39th Street, New York.—Photographic materials of all kinds. Representatives: F. Lacey, A. V. Jones, H. S. Redell. Booth 44.

United American Lines, 39 Broadway, New York.—Model 14 feet long built with unusual accuracy and detail of the S. S. *Reliance*. Representatives: H. Doblin, J. A. Lovett, J. Pannes, Charles Edwards, E. A. Winkler, James Dowd, Charles Faulkner, William Siemers, J. Jensen, W. Rehm, J. A. Pirnie, C. C. Wardlow. Booths 274 and 275.

United States Lines.—Exhibit in conjunction with the United States Shipping Board. Booth will be European in its decorations in accordance with the plan to have the Shipping Board operating companies represent in their decorations the services in which they run. Representative: E. E. McNary. Booth 258.

United States Navy, Washington, D. C.—Airplane propeller; Liberty motor; propeller for Martin-Bomber; dummy bomb, 1,000 pounds; Mark IV dummy bomb; Mark V dummy bomb; No. 230 Mark I dummy bomb; No. 520 Mark I dummy bomb; Mark III pilot directing bomb sight; 21-inch torpedo, Mark I, model 1; Mark III collapsible head for torpedo; 21-inch two-wheel torpedo truck; set of exhibition models, ⅛-inch scale, comprising the following vessels, showing the development of the vessels from the beginning of the Navy up to the present time: *Bon Homme Richard, Constitution, Enterprise, Ohio, Hartford, Monitor, Merrimac, Benton, Chicago, Brooklyn, Oregon, T. B. Winslow*, torpedo boat destroyer, dreadnaught, battle cruiser, scout cruiser, submarine, *N. C. 4*.

Exhibition models, Frigate *Vermont,* destroyer *Sampson,* submarine *S-3, Oklahoma, Connecticut, Pennsylvania.*

Range finder, Mark XI, with carriage and tripod; Mark VI mine outfit complete; telescope; stadimeter; Colt machine gun; Lewis machine gun; 3-inch dummy cartridges; 1 pounder dummy cartridge; 3 pounder dummy cartridge; 6 pounder dummy cartridge; 3"/23 dummy cartridge; 4"/50 dummy cartridge; 5" projectile, target; 6" projectile, target; 8" projectile, target; 12" projectile, target; 14" projectile, target; 16" projectile, target; 5"/51 charge, dummy; 6" charge, dummy; 8" charge, dummy; 12" charge, dummy; 14" charge, dummy; 16" charge, dummy; 5" to 14" powder tanks.

Three-inch anti aircraft gun; loud speaking radio transmitting and receiving set. Paintings showing heroic deeds of men in Navy and Marine Corps during the world war. Booths on second floor.

United States Shipping Board, Washington, D. C.—Reproduction of a suite of rooms from the "535" type of vessel; each of the four operating lines will have their own booths which will be suitably decorated according to the service in which they run. Representatives: E. E. MacNary, F. W. Wolf, J. P. Sutherland, T. J. Kehoe. Booth 250.

Valentine & Company, 456 Fourth Avenue, New York.—Valspar, Valspar varnish-stains, Valspar enamels. Representative: Dorning Walker. Booth 45.

Victor Engineering Company, Harrison Building, Philadelphia, Pa.—Victor marine ash ejector (without a pump) in full size, showing rearrangement of operating mechanism so that lower part is removed entirely into the bilge, leaving nothing visible above floor; charts of steam consumption and capacities of ejector. Representatives: E. Hahn, C. L. Bachman. Booth 12.

Wager Furnace Bridge Wall Company, 108 Academy Street, New York.—The Wager patent bridge wall for Scotch and watertube boilers for marine and stationary use. Representatives: A. Halley, L. F. Fenwick. Booth 98.

Wailes Dove-Hermiston Corporation, 17 Battery Place, New York.—Samples of Bitumastic and Hermastic solution and enamel; Bitumastic colored paints, as applied to steel plates. Representative: Linden Stuart. Booth 360.

Westinghouse Electric & Manufacturing Company, 165 Broadway, New York.—Complete model of Diesel electric propelling equipment; model of Kingsbury thrust bearing; 100 kilowatt turbine generator set; marine type 1,500 shaft horsepower reduction gear and pinion; flexible frame pinion; watertight deck winch motor and control; marine gasoline electric lighting set; one of the two types of air ejectors developed for marine use, Navy type circuit breakers, marine type bracket fans, and other examples of supply apparatus. Representatives: C. C. MacMillan, H. Peterson, H. L. McCarter, W. B. Bassett, H. W. Loren, R. D. Aldridge, C. M. Brown, R. M. Davis, L. E. Howell, N. R. Sibley, T. A. Fensenig, W. H. Easton. Booth 85.

C. H. Wheeler Manufacturing Company, Lehigh and Sedgley Avenues, Philadelphia, Pa.—Vacuum pumps and condensate pumps, also dynamometers for testing the horsepower of gas and Diesel engines, Radojet air pump. Representatives: C. Lang, J. Mullan and J. Dobson. Booth 7.

C. A. Woolsey Paint & Color Company, 500 Grand Street, Jersey City, N. J.—Display cards and descriptive matter showing "Adamant" deck paint, copper paint, yacht white, engine enamels, "Glisto" enamel, spar varnish, iron and steel bottom paint, steam compounds, etc. Representatives: P. Varley, Arthur Scott, E. D. Kelly, A. F. Hahn, F. T. Myer. Booth 13.

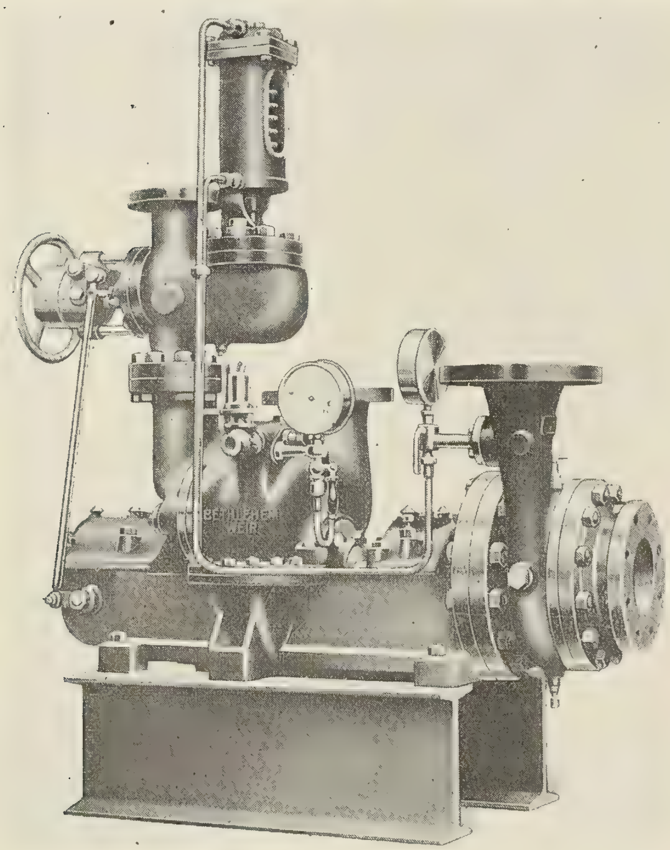
Worthington Pump and Machinery Corporation, 115 Broadway, New York.—Sixty horsepower 2 cycle solid injection Diesel oil engine of the type employed for auxiliary generator driving on board ship; small pumps and similar machinery; first direct acting steam pump ever built in the world. Representatives: W. A. Cather, M. L. Katzenstein, C. B. Humphrey, I. W. Jackman, H. L. Conklin, J. J. Morch. Booth 100.

New Devices to be Exhibited at the Marine Exposition

Turbine Driven Feed Pump

THE Bethlehem-Weir turbine drive feed pump will be shown at the Marine Exposition for the first public exposition demonstration. This pump, of the type shown in the accompanying illustration, will be a feature of the Bethlehem Shipbuilding Corporation, Ltd., exhibit.

The Bethlehem-Weir turbo feed pump consists of a steam turbine of the impulse type having one pressure and several



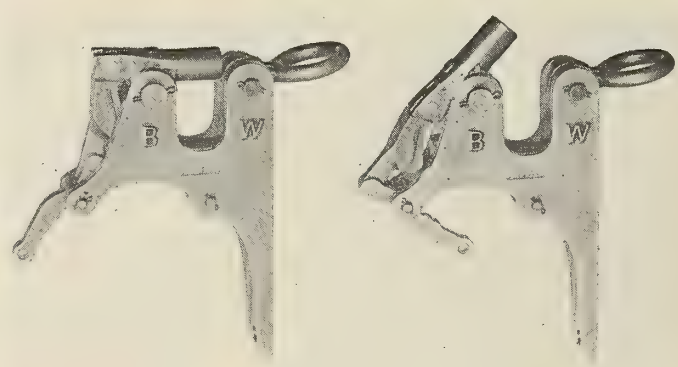
Compact Bethlehem-Weir Turbo Feed Pump

velocity stages working in conjunction with a single stage centrifugal pump of special design. The result is a compact unit which, it is claimed, gives perfect alinement, smooth and noiseless operation and is capable of pumping a steady flow of feed water against the highest boiler pressure. Variations of boiler steam pressure and pump discharge pressure are automatically controlled by a hydraulic governor. A safety governor shuts off the steam when the speed exceeds the maximum requirements for specific operating conditions.

Safety Lifeboat Releasing Device

IN order to provide an instantaneous, safe means for releasing lifeboat falls, either under normal conditions of service or when a ship is in a sinking condition, Dr. Charles Hunt, of Washington, D. C., has invented a detaching gear for lifeboats. A special feature of the device is that a lifeboat may be released while the ship is traveling at 15 knots' speed ahead and the lifeboat is dragging through the water with the full strain on the release gear. Release is also positive even with the boat dragging with her bow 60 degrees out of water.

At the present time several sets of the releasing device are



Lifeboat Releasing Device in Closed and Open Positions

being manufactured by the William Cramp and Sons' Ship and Engine Building Company, Philadelphia, Pa., for installation in lifeboats on several U. S. Coast Guard vessels. This company controls the rights for manufacturing and selling the gear.

The gear consists of only three working parts, weighs but 15 pounds and requires but 3½ hours to make a complete installation. The body may be either a bronze or a steel casting in which are fitted a toggle jointed trip for releasing the falls, a trigger which actuates the toggle, a pulley over which the trigger line is led to the release lever and a shackle to which the boat painter may be attached. A safety lock prevents accidental release and there are no projecting parts to cause danger when handling the boat.

From the illustration the releasing action of the device is quite evident. The release lever and drum controlled by one

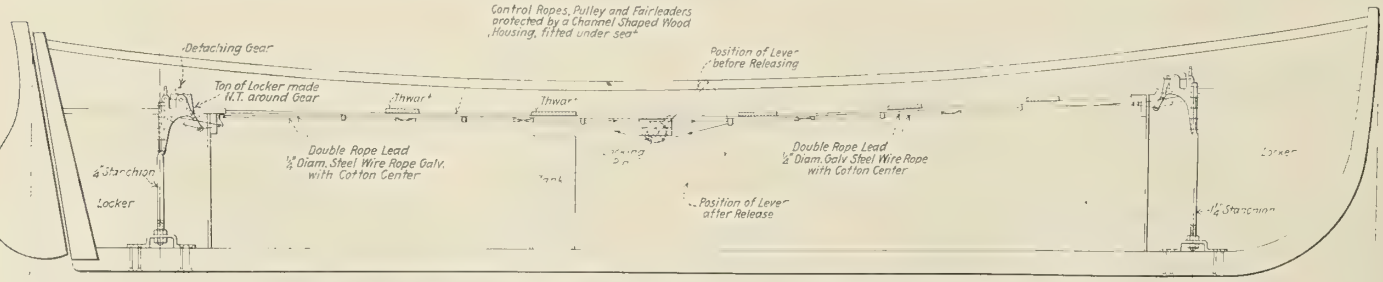


Diagram of Lifeboat Showing Hunt Releasing Equipment Installed

man are located along the thwarts of the lifeboat and trigger lines led through pulleys to the triggers of each device. The two gears are adjusted to release simultaneously and will so function under practically any condition of stress to which the ship may be subjected.

A demonstration of the detaching gears installed on lifeboats of the S. S. *General Rucker* in May, 1922, was entirely successful and called forth recommendations from those who witnessed the demonstration. As soon as the sets of gears now under construction have been installed on boats of the Coast Guard, tests will be made by the U. S. Steamboat Inspection Service for their official approval.

Mechanical Device for Steering Ships

THE Sperry Gyroscope Company, Brooklyn, N. Y., has developed a device known as the "mechanical quartermaster," which will successfully steer ships by mechanical means alone. It is claimed that the equipment has steered vessels on 4,000 mile voyages, making all courses and land falls desired.

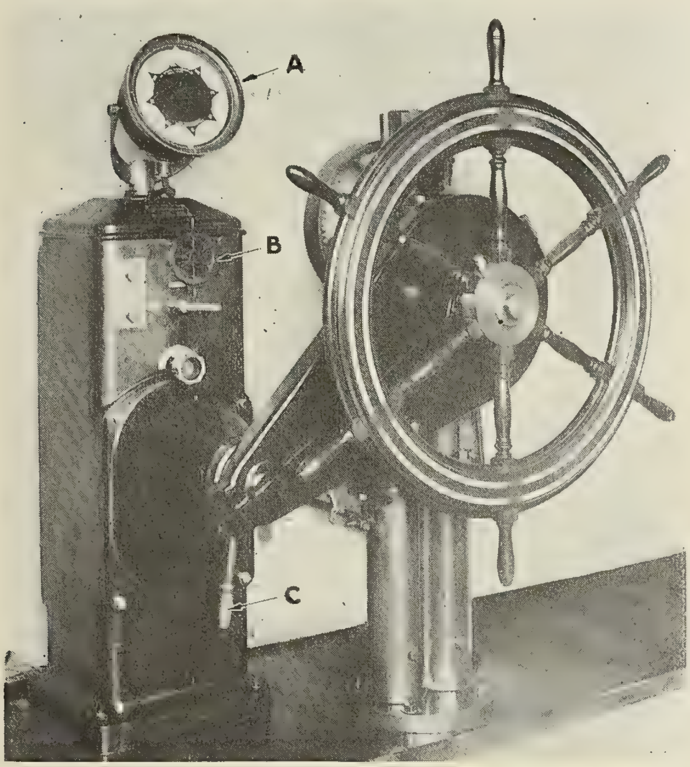


Fig. 1.—Installation of the "Mechanical Quartermaster"

The following extract from a report made by a ship's captain to the owners indicates the success of the device: "Steered all the various courses around the Florida reefs and across the Gulf of Mexico without any variation in course. Steered a straighter course than any wheelsman could steer." This latter statement is corroborated by the sample course chart shown in Fig. 2, which indicates that while the vessel was controlled by hand the course varied to a greater extent than when under the control of the "mechanical quartermaster."

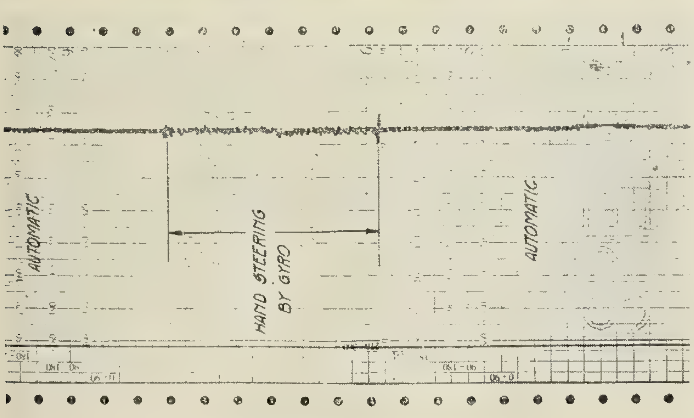


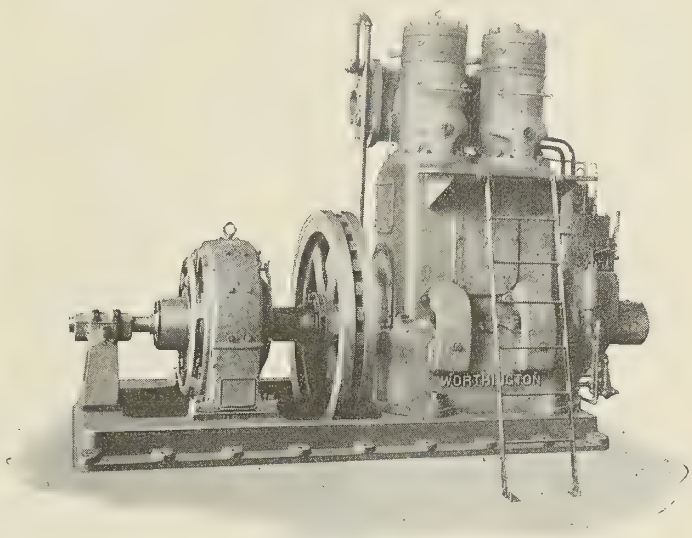
Fig. 2.—Sample Course Chart

The device has only been brought to perfection in recent months but it is the result of many years' development, work on it being halted during the late war.

The illustration of the device is shown herewith. *A* denotes the repeater compass, *B* the wheel controlling the mechanism for hand setting the desired course and *C* the clutch for disconnecting the "mechanical quartermaster" when it is desired to steer the ship by hand.

Two-Cycle Diesel Driven Generator Set

A DIESEL engine driven generator set of high efficiency for marine auxiliary current supply and emergency service has recently been developed by the Worthington Pump and Machinery Corporation, New York. The unit consists of the vertical two cylinder, two cycle type,



60-Horsepower Worthington Diesel Generator Set

solid fuel injection Worthington Diesel engine direct connected to a General Electric direct current generator. Each of the engine power cylinders has a bore of 10¼ inches and a stroke of 10½ inches. The engine develops 60 horsepower running at 375 revolutions per minute; the General Electric generator used has a rating of 40 kilowatts.

The illustration shows a complete unit which is similar to two recently ordered for the S. S. *Leviathan*. These sets are to be used for emergency service in case of accident to the main steam plant as well as for auxiliary current supply.

Insulating Quality of 85 Percent Magnesia Increased by New Process

IN the process of manufacturing 85 percent magnesia pipe and boiler coverings, the Keasbey and Mattison Company, Ambler, Pa., now uses carded asbestos fibers as the binding element. Before this time 85 percent magnesia has consisted of from 75 percent to 85 percent basic magnesium carbonate and from 15 percent to 25 percent of a relatively

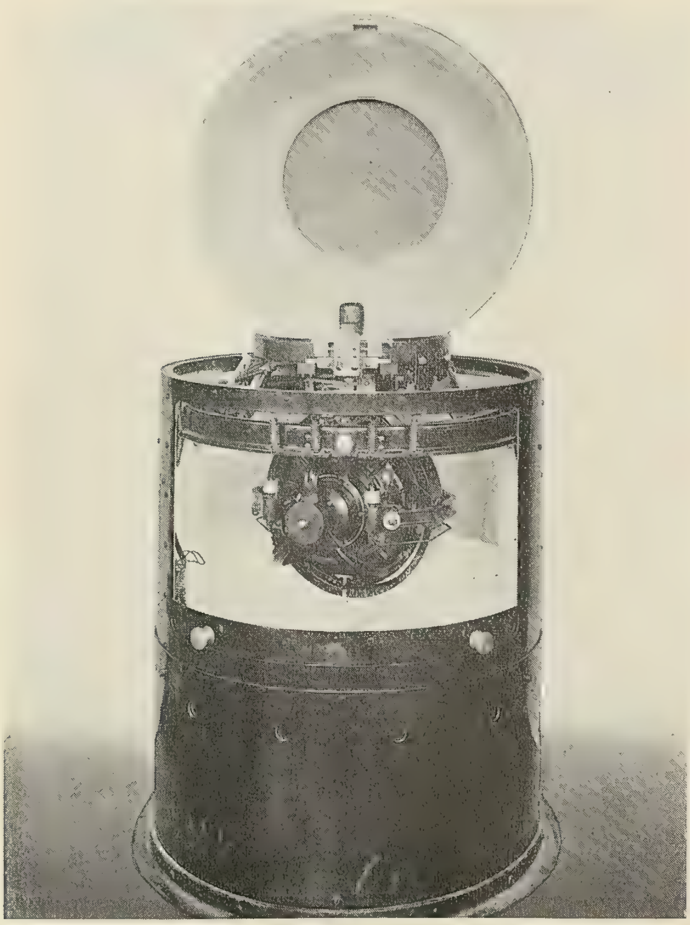
short fibered asbestos which was simply crushed and not carded.

By using the longer fiber asbestos and carding it, the required structural strength for the covering is now obtained by using 10 percent and even less asbestos. The use of the smaller percentage of asbestos permits a minimum of 90 percent basic magnesium carbonate and, since the value of insulating material is due to the cellular construction of the magnesia, which is made up of the most minute dead air cells, the resulting product insures a high insulating efficiency. The asbestos fiber itself gives little or no assistance in so far as the heat insulation is concerned, merely acting as a reinforcing constituent and binder to give the material necessary rigidity and structural strength. The manufacturers claim that increased insulating efficiencies as high as 10 percent have been demonstrated in recent tests on covering made up with the carded asbestos.

New Gyro Compass Adapted from Navy Type

THE Mark VI gyro compass, built by the Sperry Gyroscope Company, Brooklyn, N. Y., embodies new and improved features as a result of ten years' service and experience coupled with extensive research and development work. This compass is designed after the Sperry Navy Mark V compass stripped of refinements required by the Navy for gun fire control accuracy.

The design follows the single wheel mercury ballistic type. The rotor of this compass is made of bronze, runs at the conservative speed of 6,000 revolutions per minute, weighs 59 pounds and is driven by a direct current motor operating on a current of 70 volts. The system of suspension is of exactly the same general type, although slightly modified as that in previous types of single gyro compasses. A notable feature of the compass is the fact that the card is the highest part of the compass and has no obstructions over it, giving full 360-degree visual access to the card.



Mark VI Sperry Gyro Compass

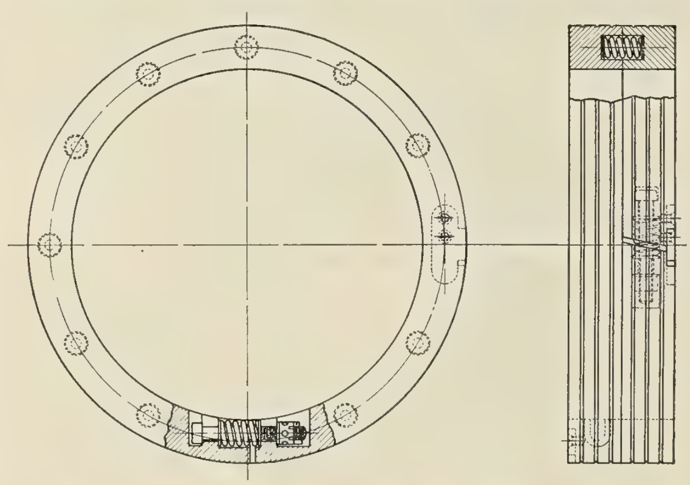
The transmitter is of the commutator type and carries a lost motion device which is designed to eliminate the hunting motion of the repeaters without introducing any actual lost motion. The azimuth motor is about the size of a 1/8-horsepower fan motor, its armature being connected to the azimuth gear through one idler gear only which simplifies this part of the equipment.

The regular source of current supply for this equipment is obtained from a small half-kilowatt steam turbo generator taking steam up to 140 pounds pressure using a reducing valve and generating current at 70 volts. In addition, the compass is wired so that it can be operated from the ship's current supply through resistance.

This compass will be a feature of the Sperry exhibit at the Marine Exposition.

Piston Rings Developed for High Pressure and Superheat Service

AFTER a thorough investigation of requirements for piston rings to withstand high pressures and high degrees of superheat for marine work, the Hooven-Owens-Rentschler Company, Hamilton, Ohio, has developed the Hamilton-Damara type piston ring which can be applied to marine reciprocating engine service.



Hamilton Damara Piston Ring, Showing Bolt for Adjustment.

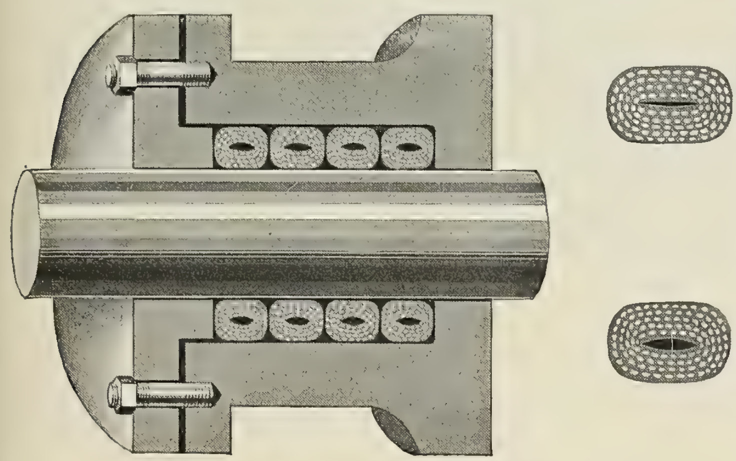
These rings are cast from single patterns made especially for each size ring. In the casting, care is taken to eliminate hardness, to check and control the precipitation of graphite, which process insures homogeneous ring castings and to insure uniform resiliency around the entire ring circumference.

It is stated that the Hamilton-Damara piston ring is virtually an adjustable plug piston, the adjustment being readily made by means of a machine steel bolt to which a special castellated case-hardened fine thread steel nut is fitted. In order that the required amount of tension may be obtained, a steel coil spring of special manufacture to withstand high temperatures under continuous tension is fitted to the ring in connection with this bolt and nut. To seal the top and bottom of the two rings which form the piston ring packing, a number of special steel coil springs are set in pockets between the two rings. These are clearly shown in the accompanying illustration.

Split Core Packing Introduced in the Marine Field

VARIOUS type packings based on the air cushion principle developed by Mustor Manufacturing Company, Inc., New York, have recently been introduced in marine service.

The oval split core packing made in spiral ring or coil form in sizes ⅜-inch up by 16th's is adapted to stuffing box service under steam pressures as high as 150 pounds where the box is deep enough to take at least 3 rings. This packing is built of cotton duck properly frictioned together around a rubber core with rubber friction compound. The special feature is the split core which is made of soft, tough, slow ageing rubber with a split running longitudinally through its center. The accompanying illustration shows how with increasing gland pressure the expansion of the packing increases, automatically opening up an air cushion.



Oval Type Split Core Packing

The cross diagonal split core packing combines the split core air cushion principle of the oval type with the well known cross diagonal packing construction. It is recommended by the company for outside and inside packed pumps, cylinder elevators and cold and hot water piston rods.

A third type packing, known as the flat ring type, for outside packed plunger pumps and plunger elevators was designed to effect an absolute seal by means of a resilient flap.

Boiler Water Level Reproduced by Gage Glass at Distant Points

AN instrument named the "Pneumercator Distant Gage Glass" has been perfected by the Pneumercator Company, Inc., Brooklyn, N. Y., to reproduce the gage glass on the boiler at full size and filled with water at distant points in a vessel. The instrument itself can be located either above or below the boiler and at any distance from it, such as the engine room, central control station or the chief engineer's office. This is of importance on oil burning vessels where in many cases each separate fire room is shut off from direct connection with the engine room, the entrance being made from the deck above. This necessitates the engineer on watch to travel from one fire room to another to read his gage glasses. By the use of the distant glass, the gage glasses for all boilers can be located at any convenient spot.

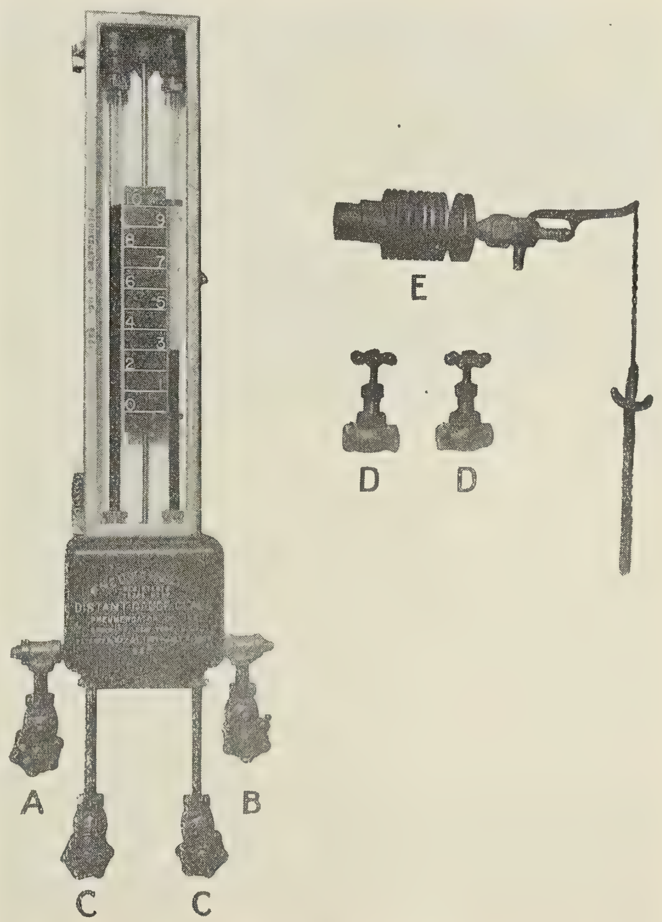
The indicating portion of the instrument itself as shown in the accompanying illustration is in its lowest terms an inverted "U" tube, each leg of which is directly connected to the boiler by ⅜-inch brass pipe; one leg which is known as the steam leg is connected to the steam space of the boiler at the top of the boiler gage glass and the other, or water leg, to the water space of the boiler below the gage glass. Both legs are cross connected by a special fitting which is called a maximum tube and which in reality is a small condenser. The center of the maximum tube is located on the same elevation as the top of the gage glass on the boiler.

When the valves connected to the boiler and the indicating portion of the instrument are open, the water leg line will fill with water directly from the boiler and the steam leg line will fill by condensation to the point where the water in the steam leg flows through the cross connection (maximum tube) back to the water leg and then to the boiler.

When these lines are both filled with water the following condition exists: The steam leg near the boiler is filled to the center of the cross connection (maximum tube) and the water leg to the level of the water in the boiler, or to the same level as the gage glass on the boiler indicates.

Now as both the water lines are subjected to the boiler steam pressure, the water is forced through the pipes to the instrument which is arranged to read the differential between the fixed head of water in the steam leg and the varying head in the water leg. The water level in the steam leg of the instrument itself always represents the bottom of the top gland nut on the boiler gage glass and when the top graduation of the sliding scale between the two columns of the instrument is placed opposite this level the actual water level in the boiler is shown in the right column of the instrument.

The tubes used in the instrument itself are standard for any size boiler and any pressure from 25 to 300 pounds. The sliding scale is laid out to correspond with the gage glass on the boiler. For instance, the illustration shows an instrument designed for a 10-inch gage.



Operating Parts Supplied with "Distant Gage Glass" Equipment. A, Steam Leg Valve; B, Water Leg Valve; C-C, Water Drain Valves; D-D, Valves; E, Maximum Tube

New Canadian Pacific Liner Montclare, of 16,400 Tons

Atlantic Liner Montclare Increases Canadian Service

The Latest Addition to Canadian Pacific Fleet Completes Construction Program for Passenger Vessels

THE passenger vessel *Montclare,* a sister ship to the *Montrose* and *Montcalm,* of the Canadian Pacific Steamships, Ltd., recently completed her maiden voyage from Liverpool to Canada. With her completion, the passenger ship program of the company is finished, the other vessels having been commissioned in the Atlantic service early in the year. The *Montclare* was built by Messrs. John Brown & Company of Clydebank, Scotland. It is interesting to note that the company has added a fleet aggregating 134,607 gross tons to its service in a single year.

General Details of the Montclare

The *Montclare,* like her sister ships, is built to Lloyd's highest classification and meets all the requirements of the Board of Trade as a passenger ship. The principal dimensions of the vessel are:

Length between perpendiculars	549.5	feet
Length on the waterline	563	feet
Breadth, molded	70.2	feet
Depth to shelter deck (C deck)	43.25	feet
Depth to boat deck	68	feet
Gross tonnage	16,400	

The vessel is of the shelter deck type with the bridge deck extending almost the full length with long erections above. Twelve watertight bulkheads, extending to the shelter deck, divide the ship into thirteen watertight compartments. A cellular double bottom, in which is stored oil fuel, reserve feed water, fresh water and water ballast, extends fore and aft the complete length of the ship and is carried well up to the bilges, giving additional protection in case of collision or accident at sea. The machinery spaces are further shielded by longitudinal bulkheads. Fresh water tanks are also built alongside the shaft tunnels.

Accommodations

Provision is made for 554 cabin passengers in staterooms amidships which are arranged for 2 and 4 passengers each. The cabin dining saloon, which extends for the full breadth of the ship, is situated on "D" deck amidships convenient to the main entrance.

At the forward end of "A" deck is the cabin lounge arranged in small bays and corners with a separate writing room and a card room at the forward end. The lounge is decorated in Georgian style, giving a very pleasing effect. Forward of the cabin lounge is the card room on the port side paneled in French walnut while the writing room is located on the starboard side. Both rooms are well lighted by large windows and have electric fires.

Abaft of the after funnel hatch on the same deck the cabin drawing room is situated with a raised deck over and a large bay window on one side. Next to this is located a children's room.

The cabin smoking room is arranged at the aft end of "A" deck. The decorative work and furnishings have been carried out with care. This apartment is fitted with a large electric fireplace which adds to its comfortable appearance. Extensive promenading space for cabin passengers is provided on "A" and "B" decks.

Third Class Accommodations

Comfortable third class accommodations are provided on "D" and "E" decks in two, four and six-berth rooms. There is also available portable accommodation for an additional number of passengers. The total number of third class passengers carried is 1,252.

The third class dining saloon is situated on "A" deck aft. Two smoking rooms and two lounges are arranged for the comfort of the passengers, one of each is situated on "B" deck aft with smaller ones on "C" deck forward.

The captain's quarters are located on the navigating bridge, the officers on "A" deck forward and the engineers on "C" deck aft complete with cabins, bath rooms, lavatories and the like. The seamen and the boiler attendants and stewards are berthed amidships on "C," "D" and "E" decks.

The galleys, pantries and bakery for first and third class dining saloons are situated amidships on "D" deck. All the latest improvements for cooking and heating have been supplied.

The heating and cooling on the ship is by means of the thermotank system which insures a temperature of at least

Drawing Room

Nursery

65 degrees F. in the coldest conditions. Ten thermotanks are fitted sufficient to change the air in any one of the compartments to which they are connected at least eight times per hour.

Cargo Handling Equipment

Cargo is handled by means of steel tubular derricks fitted on the masts and derrick posts worked by means of fourteen electric winches. Each hatch is supplied with three derricks.

The watertight doors are operated by Brunton Bros. hydraulic gear and can be opened or shut either individually or collectively from the navigating bridge.

One of the special features of the *Montclare* and the *Montrose* is that the cabins have been fitted with Henderson-Robinson patent unjammable door and lock. The edges of this type door have been cut at an angle which renders it unjammable in case of a collision or other accident that would ordinarily distort the frame, jam the door and imprison the passengers. The locks on the doors are also unjammable.

First Class Dining Saloon

Ample lifeboat accommodations, according to the standards of the International Convention, are provided for all passengers and crew. Two rows of nested boats are fitted on sliding chocks so that they can be moved from one side of the ship to the other and are placed in Babcock and Wilcox (Wylie) patent double acting davits. The remaining lifeboats are worked by "Australis" patent davits. The vessel is also fitted with wireless telegraphy, submarine signalling and gyro compass. A complete fire extinguishing service has been arranged. Pneumercator tank gages are fitted in all oil fuel and fresh water tanks with indicators in the machinery space, so that the tanks are always under the supervision of the engineers.

Propelling Machinery of the Montclare

The propelling machinery is fitted in one engine room and consists of two sets of steam turbines of the Brown-Curtis marine type arranged to work with superheated steam in driving twin screws through double reduction helical gearing. Each set of turbines consists of one high pressure and one intermediate pressure turbine in tandem driving through one set of gearing and one low pressure turbine driving through the second section of the gears. Astern turbines are incorporated in the casings of the intermediate and the low pressure ahead turbines. Adjustable thrust blocks of the Michell type are fitted to the turbines and the bearings of the turbines and gearings are arranged to work under forced lubrication. One condenser of the underhung type is fitted to each set of turbines and bolted direct to the exhaust branch of the low pressure turbine.

The main shafting is of ingot steel and each line has a Michell main thrust block fitted next to the gearing. Propellers are of the built-up type with four manganese bronze blades; the bosses are of cast steel and cast iron cones are fitted over the propeller nuts.

The auxiliary machinery includes two centrifugal circulating pumps; two Weir "Dual" air pumps; two pairs of Weir feed pumps; two hot well pumps; one Weir surface and one direct contact feed water heater; two feed water filters of the gravitation type and necessary equipment for forced lubrication as well as sanitary fresh water and other service pumps. Complete evaporating and distilling plants, auxiliary condenser and pumps are provided.

Steam is generated by ten single ended cylindrical boilers arranged for burning oil fuel under the Todd mechanical system and for a working pressure of 215 pounds per square inch. These boilers are fitted with smoke tube superheaters. Each boiler has three furnaces and Howden's type of forced draft is used. The boilers are placed in two compartments and each boiler is equipped with a working and standby oil fuel installation complete with the necessary pumps, heaters and strainers. The forced draft fans are electrically driven there being two fans and motors to each of the boiler rooms.

The refrigerator spaces in the vessel, comprising a fish and ice room, meat and poultry room, fruit and vegetable room and milk and butter room, as well as Nos. 5, 6, 7 and 8 cargo holds, are insulated on the "J.D." patent unit system of insulation, consisting of a Deltah compressed cork slab and finished with a white composite insulating slab. The refrigerating machinery and ice machines are of the latest type.

Last of Five New P. & O. Steamers Completed

Twin Screw Passenger Vessels of 15,100 Tons Built by Harland and Wolff for Emigrant Trade to Australia

With the completion of the S. S. *Bendigo,* a twin-screw passenger vessel of 15,100 tons, Harland and Wolff, Ltd., Greenock, has delivered to the Peninsular and Oriental Steam Navigation Company for its branch line service from London to Australia, via the Cape, five sister ships especially designed for the emigrant trade. The new vessel, which is classed 100 A.1 at Lloyd's, is 520 feet by 64 feet by 41 feet. Accommodation on a very complete scale has been provided for about 500 cabin passengers and accommodation is available for nearly 1,000 third class passengers on the main deck. Nine bulkheads divide the vessel into ten watertight compartments, and the double bottom is sub-divided for water ballast or fresh water, the fore and aft peaks being reserved for water ballast.

The main entrances are of a spacious and airy character. The dining saloon is a large apartment and is arranged to allow full complement of cabin passengers to dine at the same time. The framing is of a simple but pleasing character, having a teak and pitch pine dado with panelling above painted white. Every care has been taken to secure good ventilation and steam heating has been arranged all around the sides and ends of the saloon.

The music room walls are tastefully panelled and finished white with hardwood dado. This apartment is situated on the shade deck. The smoking room, which is on the boat deck aft, is panelled and painted in white with hardwood dado.

The staterooms are situated in the deckhouse on the shade

P. and O. Steamer Baradine, Sister Ship of the S. S. Bendigo

deck and also on the upper deck, and are arranged on the well known tandem principle, which ensures natural light and ventilation.

Electrical Equipment

The electrical installation consists of four main generators and one vertical oil engine driving a dynamo situated well above the waterline. All the watertight doors, which are electrically operated, can be closed simultaneously from the bridge. The ship's whistle is automatically operated electrically from the bridge.

The electrically driven gear includes large forced draft fans for the boilers, also refrigerating fans and large ventilation fans. There are two hoists for the pantry, and the dough mixer, dish washer and potato peeler are also electrically driven. Loud speaking telephones have been installed to assist in navigation, and there are considerably over 1,000 lights and above 70 motors in the vessel.

Propelling Machinery

The *Bendigo* is propelled by twin screws, driven by two sets of quadruple expansion engines, balanced on the Yarrow, Schlick and Tweedy system, thereby eliminating vibration as far as possible. The condensers are of the largest design, independent air and circulating pumps being provided. Steam is generated in 5 large coal burning cylindrical boilers working under forced draft. The engine room auxiliaries are all independent of the main engines and are of the latest and most up-to-date type.

High Speed Wire Brush for Cleaning Metal Surfaces

THE increasing use of air-driven wire brushes for cleaning metal surfaces has demonstrated the need of high rotative speed. Especially has this been true on such cleaning work as the removing of paint, rust, dirt and scale from tanks, steel ships, structural steel forms, etc., where the area to be cleaned is large and a fast rate of work is required. It has been found that a wire brush turning at high speed cleans faster and also stands up to the severe service much better than if only revolving at 2,000 or 3,000 revolutions per minute.

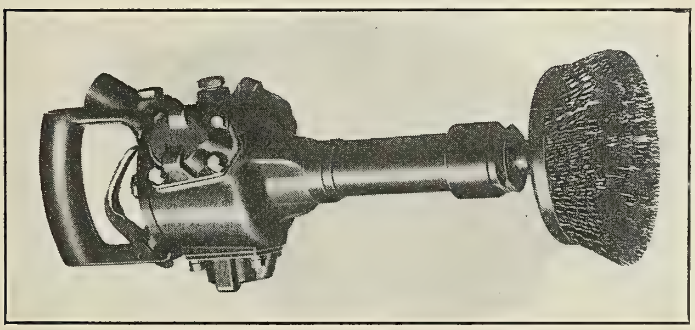


Fig. 1.—No. 601 Little David Wire Brush

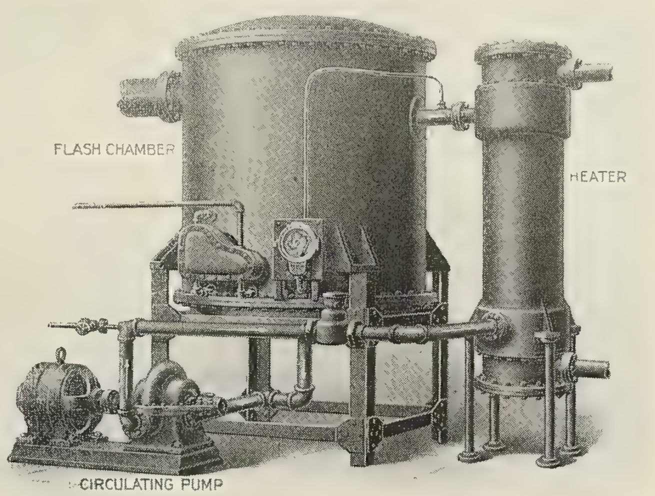
The Ingersoll-Rand Company, New York, has recently brought out a high speed cleaner (Fig. 1) known as the No. 601 Little David wire brush, which has a maximum speed of 4,200 revolutions per minute. This machine is said to be unusually successful in operation, effectively cleaning surfaces such as mentioned above and also iron and steel castings. It is designed to do a first-class cleaning job and effect a considerable saving of time and labor as well.

The air motor is of the three-cylinder type such as used in the Little David portable grinder which has been thoroughly tested out in the severe service to which pneumatic grinders are subjected. The machine is designed to be simple in construction, well balanced and operate without vibration. Light weight has been attained by using an aluminum casing reinforced with cast-in steel bushings. The weight of the complete machine is 14 pounds; the average free speed at 90 pound air pressure, 4,200 revolutions per minute; the length overall, 17½ inches and the diameter of the wire brush, 6 inches.

Non-Scaling Flash Evaporator for Producing Pure Feed Water

A FLASH evaporator having non-scaling features has been developed by the Schutte and Koerting Company, Philadelphia, Pa., for the production of pure boiler feed water. The equipment consists essentially of a tubular heater, an evaporator proper or flash chamber maintained under vacuum and a circulating pump. A distilling condenser is also used, if the vapor does not pass directly from the flash chamber to the main condenser—otherwise no distiller is required.

The raw water is heated in the tubular heater to a temperature that is both below the boiling point at atmospheric pressure and also below the temperature at which the impurities in the water are deposited as scale. This temperature is, however, higher than the temperature corresponding to the vacuum maintained in the evaporator. The circulating pump maintains the water in the heater under pressure and, as this heated water enters the evaporator, it flashes into vapor due to the vacuum existing therein.



Complete Flash Evaporator Unit

The flash evaporator is adapted for small, as well as large installations. Practically pure water is produced. It is claimed that even when salt water is used as evaporator feed the salt content of the distillate is less than 6 parts of salt in 100,000 parts of water.

The formation of scale in the heater and the precipitation and accumulation of other solid impurities are eliminated, the scale-forming impurities and other salts remaining in solution during the entire evaporation process, because of the low temperature at which evaporation takes place. This is also due to the fact that no evaporation can occur on the heating surface of the water heater. The system can be operated continuously.

The internal structure of the flash chamber is so arranged as to divide the incoming water into a multitude of thin films. This splitting of the water into slices or films is one of the outstanding characteristics of the flash evaporator and is one of the features wherein this type of evaporator differs from apparatus in which the raw water is ordinarily boiled in a large mass.

Diesel Engine Revolutions and Propeller Efficiency

Propeller Calculations for Single and Twin Screw Installations with Variable Revolutions and Fixed Speed of Ship and Also with Fixed Revolutions and Variable Speed of Ship

By A. J. C. Robertson*

ENGINEERS and shipbuilders are generally aware that low propeller revolutions are necessary to securing high propeller efficiencies, but how low these revolutions should be and what gain in efficiency can be obtained by dropping the revolutions are facts which it is very difficult to determine.

When the revolutions of the propeller are approximately the same as those of which experience has already been obtained in steamships, it is comparatively easy to forecast what the propulsive efficiency of the ship will be but, owing to the enormous weight of a slow speed Diesel engine, it has been the general practice of Diesel engineers to design their engines for higher revolutions per minute than is the case with reciprocating steam engines at present used in steamships.

It, therefore, becomes necessary, if any investigation is made of propeller efficiencies, to rely upon the data secured by model test experiments and published by Taylor, Froude, Durand, Luke, Rota and others.

*Naval architect, Munson Steamship Line, New York.

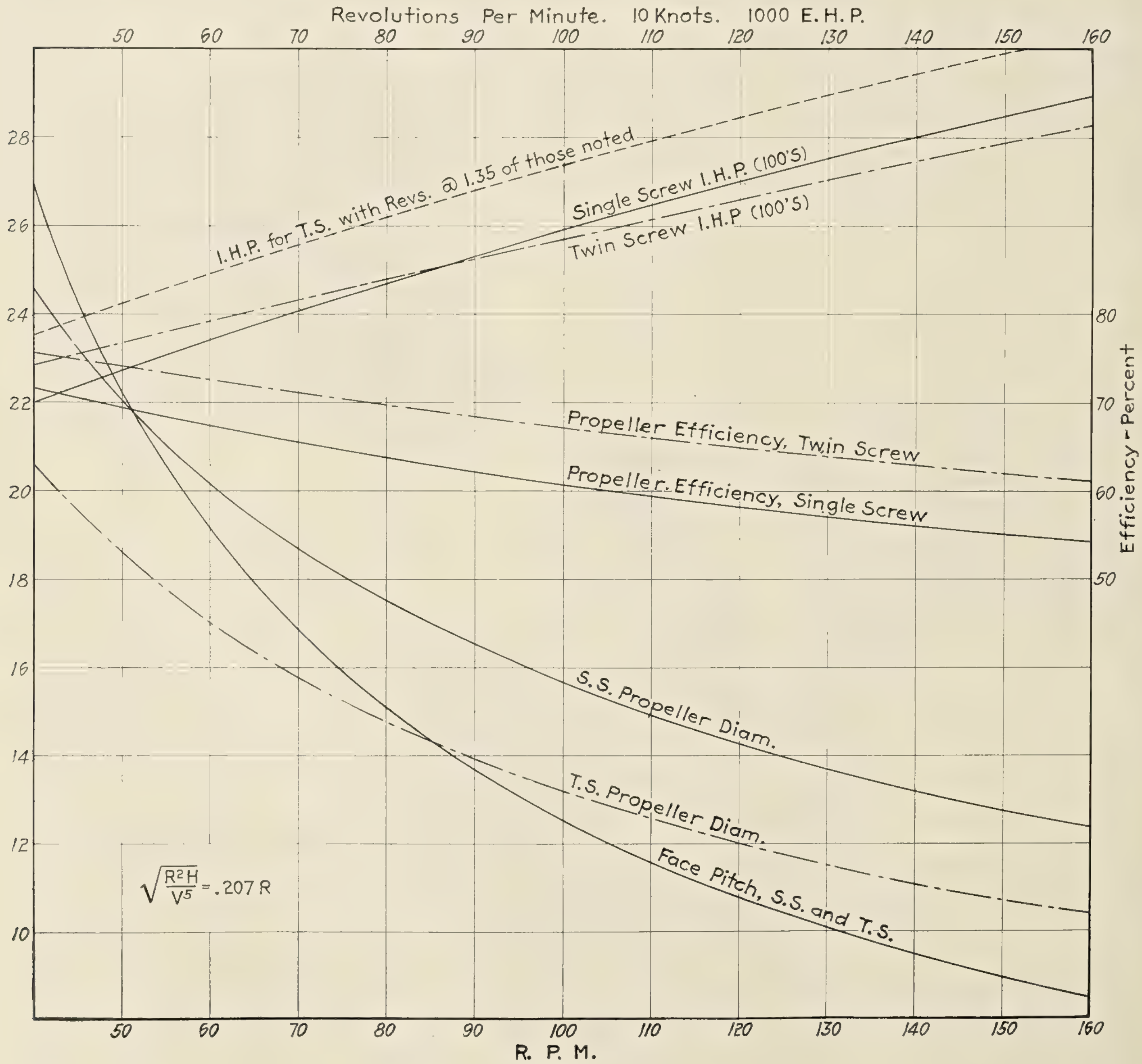


Fig. 1

Unfortunately the above data have been presented to the public in a large number of different forms, which render it inaccessible to those who have not the time to make an exhaustive study of the matter. Admiral Taylor has, however, presented a large number of his experiments in a form which is comparatively easy to apply to ship calculations, but even here the diagrams seldom extend to as high revolutions as are necessary to form a proper opinion on the subject.

R. E. Froude's classical paper on propellers presented to the British Institution of Naval Architects in 1908 is not so well known on this side of the Atlantic, but in some ways is even more useful for analysis purposes and can be plotted in the same way as Admiral Taylor's data. In the following notes the writer has made large use of Froude's as well as Taylor's model tests.

To illustrate the influence of revolutions upon propeller efficiency, the writer has assumed that it is desired to drive a ship of ten to twelve thousand tons deadweight at ten knots, and to do this it is assumed that one thousand effective horsepower is indicated by the model tests.

Estimate of Wake

When calculating the diameter and pitch of a propeller to absorb 1,000 horsepower at ten knots, the first thing necessary is to know what wake to anticipate in order to arrive at the speed at which the propeller advances in still water. This wake depends to a certain extent upon the diameter and location of the propeller, and to a very material extent on the fullness of the after lines of the vessel, such fullness being measured by the block coefficient, or more accurately by the prismatic coefficient of the after body.

I have been guided by Luke's experiments in assuming a wake fraction of 0.253 for this vessel with single screw and 0.190 for twin screw, these figures being the fraction of the speed of the ship. This gives us a speed of advance for the propeller of 7.47 knots for the single screw vessel and 8.10 knots for the twin screw vessel.

In addition we must remember that 1,000 shaft horsepower is the power required in a ship without propeller bossing, and for the twin screw vessel an allowance of 10 percent has been added to cover the resistance of the propeller bossings. It may be noted that this figure varies somewhat with the form of bossing on the ship, and to a certain extent with the amount of bossing, which is a function of the prismatic coefficient of the after lines, but 10 percent is a fair allowance to cover average practice for propeller bossings or struts.

A ship hull efficiency of unity has also been assumed.

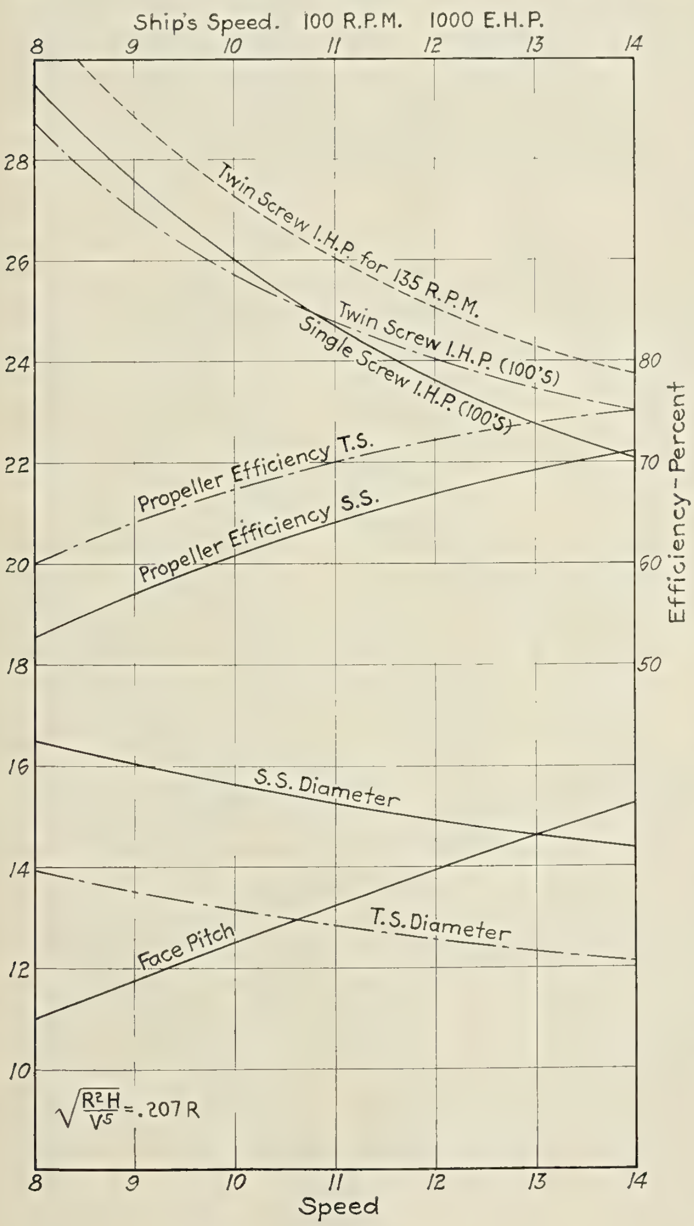


Fig. 2

Propeller Calculations for Variable Revolutions and Fixed Speed of Ship

For the above conditions propellers have been calculated with revolutions per minute of from 40 to 160, both for single and twin screw vessels, and the propeller diameters and pitches have been plotted on the diagram shown in Fig. 1.

This calculation assumes that three- or four-blade propellers of a mean breadth ratio of about 0.30, or a disk area ratio of 0.45, would be used; the blade thrust coefficient is taken as 92½ percent of Froude's coefficient for model propellers, in line with the full size thrust experiments of Holt. From these assumptions a calculation has been made of the slip ratio showing highest efficiency for the chosen revolutions and the pitch ratio and efficiencies thereby obtained. The diagrams therefore give propeller diameter, pitch and efficiency where the efficiency is highest, and it is interesting to note that the curves of pitch for the single screw and twin screw propellers are identical, though the condition of working as to load per square inch of propeller area is naturally very different.

On this diagram I have also plotted the propeller efficiencies as taken from Taylor's experiments and the corresponding indicated horsepower of the Diesel engines, assuming a rotative efficiency of 85 percent and a mechanical efficiency of 75 percent. This figure is possibly a little bit high, though higher figures are claimed for certain engines under certain conditions.

Power of Single and Twin Screws Equal at 88 Revolutions per Minute

From this diagram it will be noticed that at 88 revolutions the engine power is equal for single and twin screws, and that thereafter the twin screw engine shows a higher efficiency than the single screw installation. At 102 revolutions the power required on a single screw would be 2,600 indicated horsepower but, if put into twin screws, the revolutions would probably be, say, 130 and at that figure these engines would require to be of 1,350 horsepower each. Other comparisons are easily made from the diagram.

It will also be noted that as between 80 and 120 revolutions per minute, the excess power is 237 indicated horsepower, which would represent an additional fuel consumption per annum of approximately 150 tons. From such data it is possible to figure out whether the additional weight of the 80 revolution engine is worth accepting, or whether the addi-

tional deadweight capacity with the higher speed engine would not more than pay for the higher fuel consumption.

It is very interesting to note that the difference in diameter of the single screw and twin screw propeller is only 15 percent.

As against the higher efficiency of the single screw for this vessel it should be noted that the ratio of the disk area of the propeller to the mid-section area of the ship for the twin screw ship is better by 40 percent than the single screw ship, at equal revolutions, and this will affect the maintaining of speed at sea and the maneuvering ability of the ship. The pressure per square inch on the propeller surface, also, in a single screw ship will be higher to the extent of about 25 percent but, as this figure does not exceed five pounds per square inch for 140 revolutions, it is not a serious matter except when the vessel is pitching heavily.

Speeds at Which Single and Twin Screws Are Equally Efficient at Various Revolutions

It has been noted that the curves of the indicated horsepower for the single screw and twin screw vessel intersect at 88 revolutions per minute. A calculation has, therefore, been made to discover at what speed of the twin screw vessel the efficiency will be equal to that of the single screw vessel at 10 knots and various revolutions.

The figures are as follows:

Revolutions	60	80	100	120	140	160
Speed in knots	10.71	10.14	9.91	9.79	9.64	9.43

the twin screw being more efficient above these figures.

Case of Fixed Revolutions and Variable Ship's Speed

In addition to examining this problem for a fixed speed of ship and a series of different revolutions, I have also examined it from the other point of view of fixed revolutions and variable ship's speed, and a diagram giving these results is presented in Fig. 2.

The revolutions per minute assumed were 100 and the wake fraction for single and twin screw ships was assumed as before so that the results are an interesting demonstration of how the speed of the ship at given revolutions affects efficiency. It will be noted from this diagram that on fixed revolutions the single screw vessel shows up better at the higher speeds.

The revolutions of the twin screw engines at various speeds to give efficiencies equal to the single screw engine at 100 revolutions per minute are as follows:

Speed in knots	8	9	10	11	12	13
Revolutions per minute	115.3	111.2	105.6	94.3	89.5	77.0

Both of these comparisons assume that the engine revolutions at 1,000 horsepower and 550 horsepower would be alike, but this is not the case; in general service it is found that the revolutions vary inversely with the square root of the horsepower which would make the revolutions for the smaller engine 135 compared with 100 for the larger. On this basis the indicated horsepower for the twin screw engines has been calculated for both diagrams, and is shown in dotted lines; it will be noticed that the power of the twin screw machinery is approximately 5 percent higher than the single screw through the range of our calculations. I believe this fairly represents the difference in propeller efficiency between the two methods of propulsion, but, as already pointed out, a choice of revolutions per minute cannot be made solely on the question of lowest indicated horsepower because, in reducing revolutions, weight, first cost, cost per deadweight ton, and interest charges go up, and deadweight carrying capacity drops as well as fuel consumption, and it is a question of ship economy as to what revolutions should be accepted.

The utility of these diagrams can be very much increased when it is remembered that the pitch ratio and propeller efficiency is constant for the same revolutions squared, multiplied by horsepower and divided by speed of advance to the fifth power $\left[\frac{R^2 \times H}{V^5}\right]$, and propeller diameters vary with the speed of advance divided by the revolutions.

Examples

One or two examples of the use of this diagram may be given:

(1) Assuming a speed of 10 knots and 1,000 effective horsepower, at what revolutions would a single screw electrically driven engine require to run in order to give efficiencies equal to a pair of twin screw Diesel engines running at 130 revolutions per minute, the efficiency of the electric drive being taken as 90 percent? From diagram I the twin screw outfit consumes 2,700 indicated horsepower, therefore the equivalent power for the single screw Diesel drive will be 2,700 multiplied by 0.90, equal to 2,430 indicated horsepower, and from the diagram the electric motors will have to run at a speed of 74 revolutions per minute, the respective propeller diameters being 11 feet 6 inches and 18 feet 2 inches.

(2) Apply diagram (1) to a ship of 8½ knots and requiring 420 effective horsepower (bare model) and ascertain whether a single screw at 140 revolutions per minute or twin screws at 175 revolutions per minute would be more economical in power.

As $\sqrt{\frac{R^2\,H}{V^5}}$ is constant for equal efficiencies the revolutions on the diagram should be increased in the ratio $\sqrt{\frac{420}{1000}} \times \left(\frac{10 \times .747}{8.5 \times .747}\right)^{2.5}$ i.e. by 1.0277.

Then read revolutions $140 \times 1.0277 = 144 = 2{,}820$ indicated horsepower and $175 \times 1.0277 = 180$ revolutions per minute and by exterpolation we read 2,915 indicated horsepower for twin screws, or correcting these figures for this proposal $\frac{420}{1000} \times \begin{cases} 2820 = 1184 \\ 2915 = 1224 \end{cases}$ and the twin screw

$$\underline{} \; +40$$

ship would require 40 more indicated horsepower than the single screw ship equal to, say, 30 tons of oil fuel per annum.

At 140 revolutions per minute of engines = 14.4 on diagram, diameter = 13.0 feet.

Pitch = 9.25 feet and, as these vary as $\frac{V}{R}$, the new diameter and pitch would be—

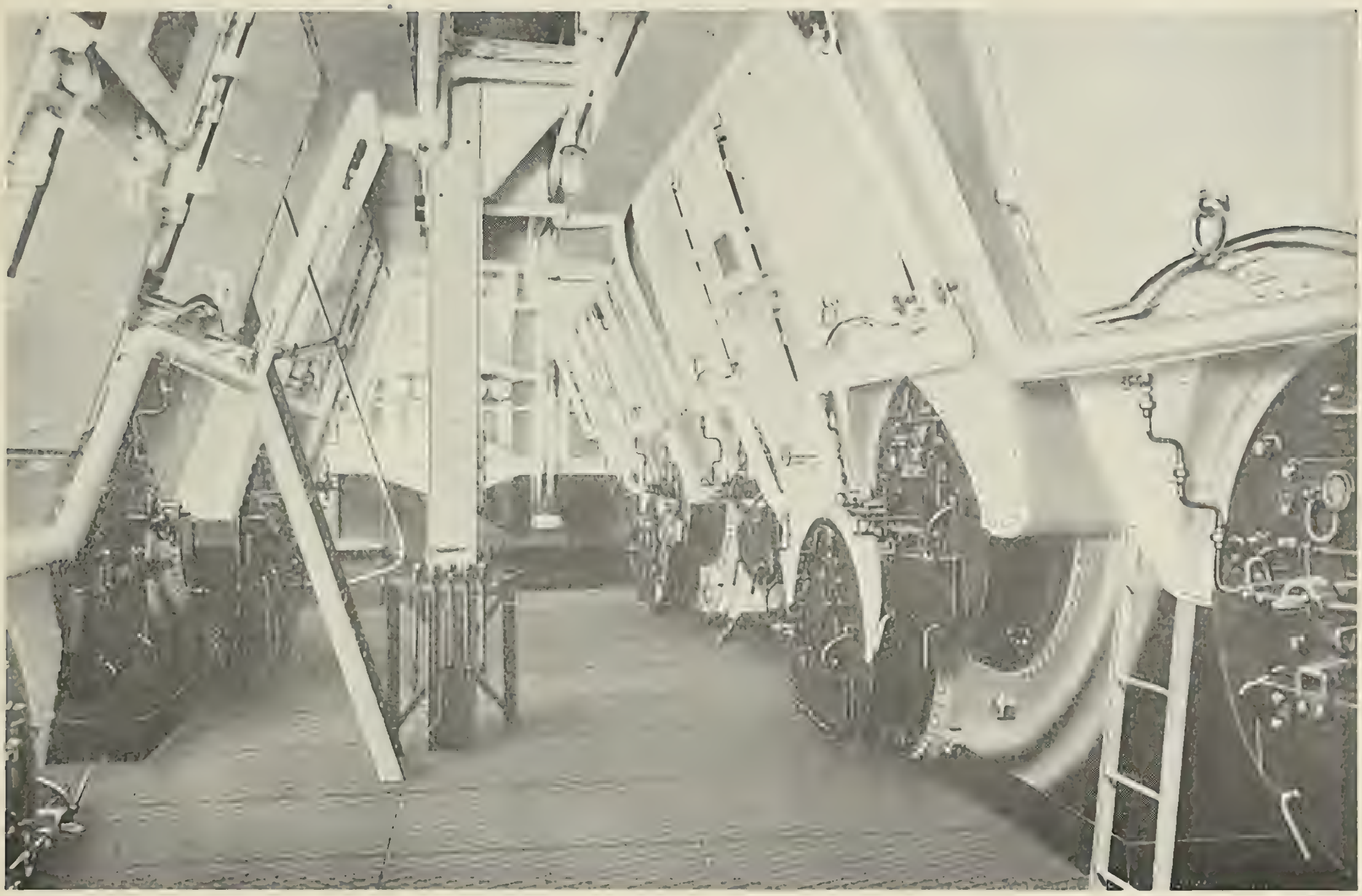
$$\text{Diameter} = 13 \times \left\{ \frac{8.5}{10.0} \times \frac{144}{140} = .8742 \right\} = 11.36 \text{ feet.}$$

$$\text{Pitch} = 9.25 \times .8742 = 8.08 \text{ feet.}$$

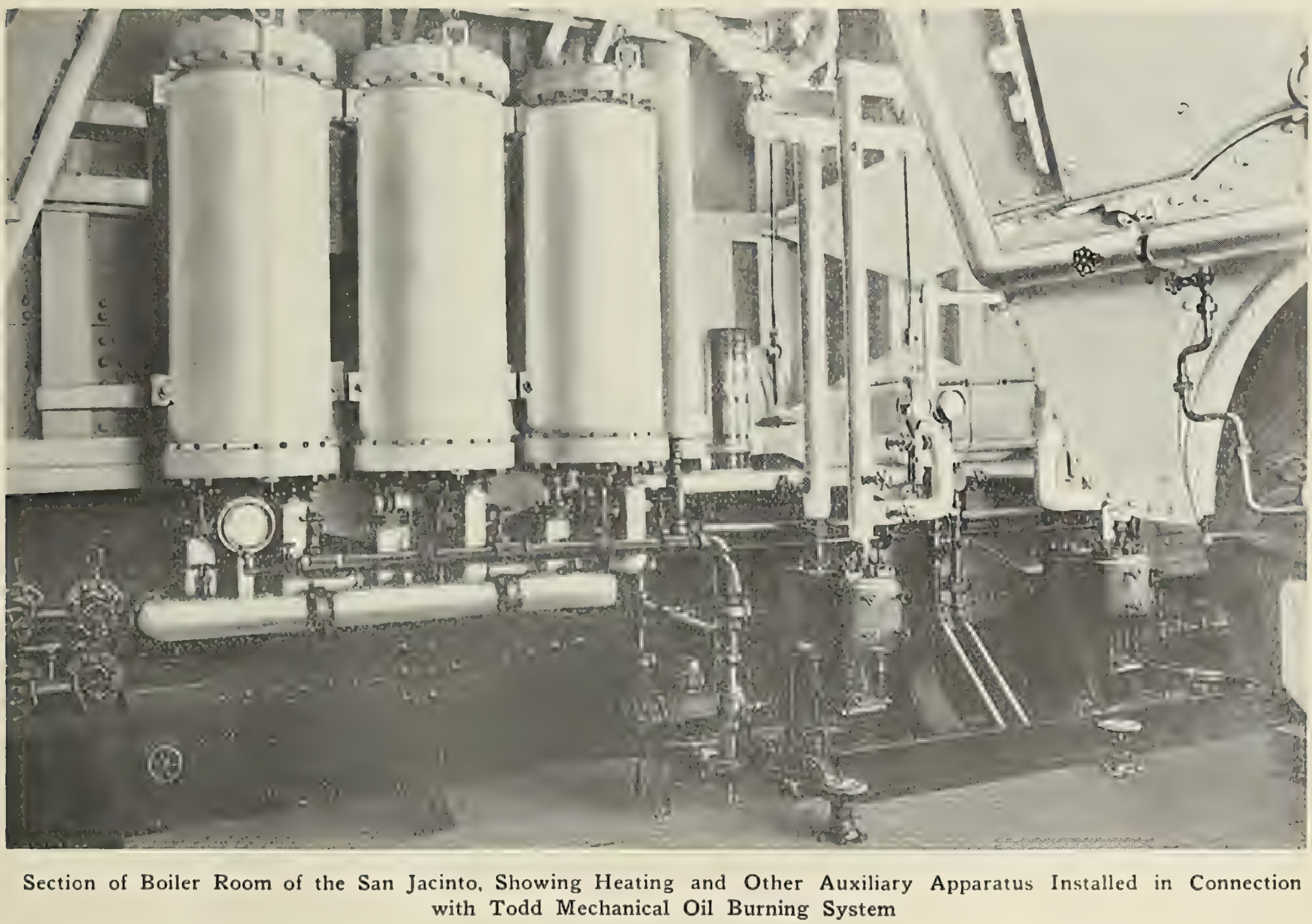
Todd Oil Burning Equipment to be Installed on Passenger and Freight Vessels

Contracts for the installation of mechanical fuel oil burners in twelve passenger and freight vessels have recently been awarded to the Todd Shipyards Corporation. These vessels, totaling 78,100 indicated horsepower, include the *Empress of Scotland* of the Canadian-Pacific Steamships, Ltd.; the *Calamares, Pastores, Limon, Esparta* and *San Jose* of the United Fruit Company, the *El Cid, El Siglo, El Dia* and *El Rio* of the Southern Pacific Company and the *City of Jacksonville* of the Mallory Line.

The work on the five fruit steamers and the Red Star liner *Kroonland,* which is being fitted with Todd mechanical



Boiler Room of Mallory Line Steamship San Jacinto, Showing Installation of Todd Mechanical Oil Burners



Section of Boiler Room of the San Jacinto, Showing Heating and Other Auxiliary Apparatus Installed in Connection with Todd Mechanical Oil Burning System

oil burners in place of an older type system that was installed some time ago, is being carried out at the plant of the Robins Dry Dock and Repair Company in Brooklyn. The remaining vessels of the United Fruit Company and the *City of Jacksonville* are being converted at the plant of the Tietjen and Lang Dry Dock Company in Hoboken.

The accompanying illustrations show the firing aisle and fuel feed tanks of the *San Jacinto* which was recently completed. An excellent idea of the appearance of the oil burning equipment in a finished installation may be gained from the work on the *San Jacinto*.

The *Empress of Scotland* will be fitted with Todd burners on her next arrival at an English port by Todd Oil Burners, Ltd. of London. She was formerly the Hamburg-American liner *Kaiserin Auguste Victoria* of 24,581 gross tons. There are fifty-one furnaces in this vessel and the decision of her owners to replace her oil burners with Todd mechanical equipment followed the successful performance of the Canadian Pacific Steamships, Ltd., new liner *Montclare*. This vessel was equipped with this type burner before she left the yards of her builders, the John Brown Company at Clydebank, Scotland.

Newport News Yard Has Plant for Producing Navy Standard Paint

FOR a number of years the Newport News Shipbuilding and Dry Dock Company has been manufacturing Navy standard bottom paint according to Navy specifications for use on all Government vessels built at the plant. The plant in which the manufacture of paint is carried on consists of the manufacturing shop in which are installed stone and iron mills and agitators. This shop has a capacity of 800 to 1,000 gallons of paint per day. Adjacent to the paint shop is an oil storage building where the various mixing oils are stored. A third section contains the marking and storage departments in which the finished products are handled. Here also is located the shipping department from which paint sold to outside firms is distributed. This section completes the paint plant.

Mixing Department of Paint Plant

During the past year the Newport News Shipbuilding and Dry Dock Company was awarded the United States Shipping Board paint contract for all ports from Newport News, Va., to Galveston, Texas. The specifications for this paint were identical to the Navy standard formula. In addition to the other products of this plant, the company has put a marine bottom paint on the market for which the producers claim high quality, durability and reliability at a moderate price to shipowners and operators. This paint, known as Newport News Shipbuilding and Dry Dock Company's composition, is marketed at all ports along the South Atlantic and Gulf coasts.

A great deal of the paint being used in connection with the reconditioning of the *Leviathan* has been manufactured at the paint plant of the shipyard.

In addition to the production of marine bottom paints, the Newport News paint plant also manufactures a variety of other marine paints, including topside paints, copper paints and hold paints.

* * * *

(Photograph from Kadel and Herbert, N. Y.)

The British Navy's Latest Aeroplane Carrier

H. M. S. **Ark Royal**, the British Navy's latest seaplane carrier, photographed at Weymouth. On the forecastle can be seen two cranes (lowered), which are used to hoist the machines when they alight at sea.

Recent Developments in Marine Insurance

Modified Hague Rules Endorsed—Possible War Blockade Causing Insurers Anxiety—Protection Clause Against Bootlegging Operations

By "Bordereaux"

IT is, perhaps, well to understand the exact attitude of American marine underwriters with respect to carriage of goods by sea, as represented in the recommendations by them to the American conferees at the recent international meetings at London and Brussels. In this country the Hague Rules became much more acceptable to insurance men when disguised by the amendments made by the Imperial Shipping Committee, and the American Institute of Marine Underwriters unanimously voted the amended proposals as "a substantial improvement upon the rules as formerly drawn, and that those rules, as so amended, represent a desirable improvement upon existing law." But the Institute felt that our conferees should urge a few additional changes, the substance of which was as follows:

1. That the rules be extended to include "on deck" cargoes.
2. That the rules should be made to apply to cargo so long as it is in the custody of the carrier and not merely while waterborne.
3. That the notice clause should be amended so any notation of loss or damage on receipt given to carriers should be deemed sufficient notice of claim.
4. That the carriers should be exempted from losses occasioned by fire only when such fire is not caused by design or neglect of the carrier.

With respect to the third proposed amendment it should be borne in mind that our courts have held that notation of damage on receipt given by consignees to carriers does not constitute an actual notice of claim, and there seemed to be no serious objection to the amendment as suggested by the Institute.

There is no doubt that if these rules are to be useful they should be made mandatory. The Institute's thought is that ultimately treaties will be entered into by the various maritime countries, and such treaties will have the effect of making these rules mandatory in the case of all bills of lading issued in such countries.

War Risk Conditions

WAR risk coverage is again to the fore, owing to the serious disturbance in the Near East and a reasonable apprehension that it may develop into something more widespread and grave. Underwriters are quoting war rates to Greek ports at ½ percent, and to Constantinople at 2 percent, subject to forty-eight hours' acceptance. Greek and Turkish vessels are excluded from these rates. War risk, in the New York market, is placed under a form of cover which limits the protection to "waterborne only," and underwriters are reluctant to extend this form to cover property while on shore. The risk of strikes, riots and civil commotions is, of course, covered on shore, but this protection does not include damage or destruction from the acts of organized warfare.

The possibility of a blockade is causing insurers anxiety because this would oblige vessels to discharge at other than the port of destination; and this involves expense of a nature that underwriters do not feel liable for under the war risk clauses, but nevertheless one that they frequently defrayed during the recent war.

The language of the war clause employed by the great majority of American underwriters reads as follows: "Excluding claims for delay, deterioration and/or loss of market, and warranted not to abandon in case of capture, seizure or detention, until after condemnation of the property insured, nor until sixty days after notice of said condemnation is given to these insurers. Also warranted not to abandon in case of blockade, and free from any claim for loss or expense in consequence of blockade, or of any attempt to evade blockade, but in event of blockade to be at liberty to proceed to an open port and there end the voyage."

The frustration clause is another thorn in the side of the underwriter. A large number of banks are declining to accept policies covering war risks, if this clause is included. The argument of the banks is that one of the really serious elements of the situation is the possibility of our Government refusing to permit vessels to sail for the war zone. Subsequent to the *Sanday* decision by the British courts this clause came into general use, despite the fact that that case did not directly involve underwriters. The position of the insurers is that whereas they are willing to cover against the acts of belligerents they do not care to assume liability for losses arising out of the imposition of a government embargo against the sailing of vessels to the Near East. They feel that the banks are already abundantly protected through their rights against the cargo.

Still another source of apprehension is the possibility of shippers making use of a route via Trieste with subsequent transshipments by rail from that port. This involves extra hazards and the likelihood of additional claims and is a situation not contemplated in the original undertaking.

In this connection it is interesting to note that a number of underwriters are making use of an altered war clause that conforms to the requirements of a recent British court decision with respect to liability for seizures of the property of the assured by de facto governments, the latter not being governments in the meaning of the clause. The recent changes are here given in italics: "Including direct loss and/or damage caused by strikers, locked-out workmen or persons taking part in labor disturbances, riots, civil commotions or explosions, the result of unlawful acts, but, notwithstanding anything to the contrary, either expressed or implied herein, or in the policy to which this endorsement is attached, this insurance does not cover and is hereby warranted to exclude claims for delay, deterioration or loss of market, or for confiscation or destruction by the Government, *and/or de facto Government,* of or within the country in which the property is situate and/or the Government, *and/or de facto Government of seceding or revolting States.*"

Portuguese Revolution Coverage

REQUESTS have been coming in to underwriting offices for insurance against the hazards of revolution in Portugal, and they have chiefly arisen through the insistence of certain banks for protection of this character. Inquiries among steamship lines operating to Portugal and an interview with the Portuguese consul have failed to elicit any information as to why this sudden demand should be made, but shippers must secure the coverage their banks demand. There is a general lack of confidence in the stability of the present Portuguese Government and this is

somewhat accentuated by the continued depression of Portuguese currency and the recent passage of a very stringent tax law. The insured should bear in mind that the strike and riot clauses most commonly in use in this market do not include the risk of revolutions unless the latter is specially inserted. Underwriters feel that it would be a mistake to include in their general strike and riot clause the risk of revolutions, this being a hazard of much more serious nature than either strikes or riots, and ought to be dealt with separately. The ordinary war clause does not cover on shore, and that is where most damage from a revolution would most likely occur; nor is it certain that damage on sea by revolutionists would be covered inasmuch as such acts would not be committed "in prosecution of hostilities between belligerent nations." Current quotations for insurance against the results of revolutions in Portugal, as applied to shipments, vary from an eighth to a quarter percent.

Bootlegging Hazards

In these days of wholesale bootlegging and rum-running underwriters are obliged to give careful consideration to hazards thus involved. Suspicion attaches to the surprisingly numerous applications for coverage on yachts and other vessels operating to and from the West Indies. It is believed by underwriters that the warranty as regards illicit and prohibited trade is sufficient to relieve them in the case of most vessels, and that they are further protected against confiscation by the warranty applicable to seizure, arrest, restraint, etc. In the case of yachts, which are so frequently mediums of bootlegging, the restriction that they are to be used for pleasure purposes only, it is felt, is a sufficient protection to the insurer. The illicit trade warranty reads as follows: "It is also agreed that the property be warranted by the assured free from any charge, damage or loss, which may arise in consequence of a seizure or detention, for, or on account of any illicit or prohibited trade, or any trade in articles contraband of war."

W. D. Winter, in his work on "Marine Insurance," says, in this connection:

"It would also appear that there must be read into this clause 'loss—which may arise—for, or on account of any—trade in *the goods hereby insured,*' otherwise an innocent shipper might be prejudiced by the seizure and detention of his goods merely because they happened to be in the same vessel with other goods liable for seizure or detention on account of illicit, prohibited or contraband trade."

Carriers' Liability in Italy

The Merchants' Association of Genoa recently entered into an arrangement with a number of Italian steamship companies with regard to shortweight in shipments of coffee from Brazil to that port. The arrangement is as follows:

1. Damaged and undamaged bags weighing at least 58,500 kilograms do not call for any claim. If the bags weigh less than 58,500 kilograms a shortweight indemnification will be admitted.

2. For bags showing shortweight the difference in weight will be calculated on the basis of 59,000 kilograms. On the same basis there will also be calculated the difference existing between the weight ascertained when goods are shipped and the weight at the time of discharge.

3. For shortweight thus ascertained steamship companies surrender to consignees as indemnification the net remainder of the loose quantity on board.

4. In case the loose quantity in question is not equal to the entire shortness, the steamship company pays 50 percent of difference in weight according to invoiced original price.

5. Steamship companies, as well as consignees, are engaged to provide the necessary supervision so that all the loose coffee on board and in the lighters is gathered, weighed and delivered to the warehouse of the freeport.

6. The weight of bags with shortweight has to be ascertained within eight days after completion of discharging, for shipments up to 6,000 bags; this period will be extended by one day for every full or commenced lot of 1,500 bags more.

7. This arrangement is in force until revoked and has retrospective effect for steamers which have entered Genoa on or after October 1, 1922.

Insurance of License Suspension

They are doing a land-office business in England in the insurance of British sea-going officers against the risk of a suspension of their licenses. This is a new proposition. Policies are being issued by the Navigators and General Insurance Company. For an annual premium of 12s. 6d. the company guarantees the assured during suspension the payment of a monthly sum equaling his monthly salary, and also a full allowance for food, accommodation and attendance of a nature identical with that provided the policyholder at the time of his suspension. The maximum monthly payment is £50.

British Hull Market Active

There is a revival of activity in hull coverage in England at this time. Renewals are coming in briskly and, what is of more significance, vessels are being freely written whose insurance does not expire for several months. This is taken as indicating that owners regard prevailing conditions as advantageous for placing their risks. It would appear to suggest either that an impression is at large that rates are likely to advance with the end of the year, or that the market has reached its bottom and that nothing is to be gained by further delay. Underwriters welcome the business, both because it places them on a sounder basis and because it is taken as indicating that shipowners have faith in their ability to keep their vessels employed.

The Sold Wooden Ships

It has been a matter of gratification to underwriters that the contract under which the 226 wooden Shipping Board vessels were sold requires "that they are not to be used for transportation purposes as steamships, and that they will be promptly dismantled within a reasonable time, after the legal documents have been executed." There is rejoicing in underwriting offices that at last the hour is at hand when insurance companies are no longer to be threatened with extinction for their unwillingness to insure these undesirable risks. By the contract of sale they may be used as barges, but past experience has demonstrated that in most instances the hulls are too heavy for that purpose.

Hazards in Use of Extra Ports

If additional evidence is required to sustain the position of underwriters that serious extra hazards are involved in the use of additional ports in the passage it is at hand in the case of a steamer that recently sailed from New York for Batavia and deviated via Jacksonville, Fla. On coming out of Jacksonville, she grounded, necessitating her being sent to Newport News for repairs, thus entailing substantial extra expense upon her underwriters in addition to opening the average warranties. Following the heavy losses sustained by underwriters in the deviations made by the steamers *Welsh Prince* and *Jethon,* it is felt that every justification exists for additional charges for the use of ports on the passage.

Line Shafts for Marine Internal Combustion Engines

By Joseph Hecking*

This article is an analysis made in connection with the revision of the rules of the American Bureau of Shipping for line shafts of internal combustion engines. It will be found of special interest in cases of contemplated conversion from steam to oil engine drive as it shows the flywheel effect and the cylinder sizes and arrangement suitable for retaining existing shafting. In this connection the reader is also referred to Mr. Hecking's article on "Diesel Engine Crankshafts," published in our February, 1921 issue.

THE turning efforts of reciprocating oil engines are subject to wide variations during the period of a cycle. The variations or the ratio of maximum to minimum turning effort is greatest for one-cylinder engines and decreases with the increase in number of cylinders. In order to bring the cranks over the dead centers and over the period when no positive turning effort is produced the fitting of flywheels becomes a necessity. Without a flywheel and without the flywheel effect of the rotating engine parts, engines would come to a sudden stop at the point of the stroke corresponding to the intersection of the resultant turning effort curve with the zero torque line. Where the resultant torque line does not intersect the zero line the fluctuations in speed would be too great for practical purposes, excepting engines with a large number of cylinders.

It is the function of the flywheel to absorb effort when the turning efforts are above the mean and to surrender the absorbed effort when the turning efforts are below the mean, thus tending to equalize the effects of the irregular turning efforts in their transition to perform work. This theory presupposes that the resistance is uniform during the whole cycle, i.e., that the power developed during the power stroke is uniformly absorbed by the propeller. This is, however, not exactly true, as actual torque diagrams taken from various engines have fully demonstrated. There are a number of other considerations such as misfiring, pre-ignition, torsional vibrations, etc., which make it advisable to calculate flywheels with an ample margin of safety.

Excess turning efforts cause an increase in the velocity of the crankpin, and vice versa. The excess over the mean turning effort causes a maximum velocity near the end of the power stroke, representing the accumulation of the excesses at all the momentary crank angles during this stroke, and the deficiency of turning effort causes a minimum velocity near the beginning of the power stroke. Inasmuch as the power generated is equal to the resistance, the increase in the velocity at the end of the power stroke represents the excess of power E developed during this stroke and is equal to the kinetic energy of the flywheel.

Energy Stored in Flywheel

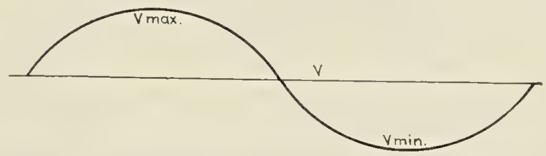
The kinetic energy in foot-pounds stored in a flywheel is approximately:

$$E = \frac{W V^2}{2g} \qquad (1)$$

wherein, W = Weight of flywheel rim in pounds.
V = Velocity in feet per second of the wheel's periphery
g = Acceleration = 32.16

By taking the weight of the rim only and the velocity of the outside diameter in place of the center of gravity the kinetic energy of the wheel is somewhat overrated; but the hub and arms of the wheel, as also the rotating masses of the engine proper, produce kinetic energy which is generally ignored in flywheel calculations. As an additional margin of safety the indicated power has been taken as the basis of calculations, ignoring the friction losses in cylinders and bearings and also the power absorbed by attached auxiliaries. The power delivered to the lineshaft, i.e., the shaft horsepower, is from 70 to 80 percent of the indicated horsepower and the flywheel effect based on rim weight and peripheral velocity is considered to safely cover all conditions.

The fluctuation C above and below the normal velocity of the crankpin, due to the irregular turning efforts, is indicated in Sketch 1. It is evident that the greater the fluctuation the smaller the flywheel effect and the greater the irregularity of the effect of the turning efforts. The kinetic energy to be stored in a flywheel for a predetermined fluctuation depends on the difference in the extreme velocities squared or $V\ max.^2 - V\ min.^2$ This fluctuation C is best expressed in terms of the mean velocity V and may be determined as follows:



Sketch 1.—Showing Fluctuations in Velocity of Crank Pin

$$C = \frac{V\ max. - V\ min.}{V}\ ;\ \text{or}\ V\ max. - V\ min. = C\ V$$

$$\frac{V\ max. + V\ min.}{2} = V;\ \text{or}\ V\ max. + V\ min. = 2\ V$$

$$(V\ max. - V\ min.)\ (V\ max. + V\ min.) = C\ V \times 2\ V$$
$$V\ max.^2 - V\ min.^2 = 2\ C\ V^2$$

Inserting this value in formula (1) the required flywheel effect to produce a required kinetic energy E under a predetermined speed fluctuation C, is

$$E = \frac{W\ 2\ C\ V^2}{2\ g} = \frac{W\ C\ V^2}{g} \qquad (2)$$

If R = Revolutions of engine per minute and
F = Outside diameter of flywheel in feet,

$$\text{Then } V^2 = \left(\frac{F \pi R}{60}\right)^2 = \frac{F^2 \pi^2 R^2}{60^2} = \frac{F^2 R^2}{365}\ ;$$

Inserted in equation (2).

$$E = \frac{W\ C\ F^2\ R^2}{32.16 \times 365}\ ;$$

If W = weight of the flywheel in thousands of pounds

$$E = \frac{1{,}000\ W\ C\ F^2\ R^2}{32.16 \times 365} = \frac{W\ C\ F^2\ R^2}{11.75}$$

E is expressed in foot-pounds, but the diameter and stroke of engines (functions of E) are always expressed in inches. With E in inch-pounds

$$E = \frac{W\ C\ F^2\ R^2 \times 12}{11.75} = W\ C\ F^2\ R^2\ \text{(nearly)} \qquad (3)$$

*Engineer Surveyor, American Bureau of Shipping, New York.

Table I

Stroke	Crank Angle	Press. Per Sq. In. of Piston Area	Press. in Percent of Max. Press. 500 Lbs.	Piston Load = Percent Press. × .7854 D^2	Torque Arm in Percent of Stroke	Turning Moment in Percent of D^2PS	Turning Force D^2PS/r, $S=2r$
Power	Top	391	.782P	.614D^2P	—	—	— D^2P
	15	397	.794	.623	.1575	.098D^2PS	.196
	30	319	.638	.502	.298	.150	.300
	45	193	.386	.303	.410	.125	.250
	60	119	.238	.187	.482	.090	.180
	75	91	.182	.143	.511	.073	.146
	90	94	.188	.148	.500	.074	.148
	105	100	.200	.157	.455	.072	.144
	120	106	.212	.166	.384	.064	.128
	135	112	.224	.176	.297	.052	.104
	150	115	.230	.181	.202	.037	.074
	165	119	.238	.187	.102	.019	.038
	180	112	.224	.176	—	—	—
Exhaust	195	−78	−.156	−.123	.102	−.013	−.026
	210	−75	−.150	−.118	.202	−.023	−.046
	225	−69	−.138	−.108	.297	−.032	−.064
	240	−57	−.114	−.090	.384	−.035	−.070
	255	−41	−.082	−.064	.455	−.029	−.058
	270	−15	−.030	−.024	.500	−.012	−.024
	285	+9	+.018	+.014	.511	+.007	+.014
	300	37	.074	.058	.482	.028	.056
	315	66	.132	.104	.410	.043	.086
	330	91	.182	.143	.298	.042	.084
	345	103	.206	.162	.157	.025	.050
	360	109	.218	.171	—	—	—
Suction	15	−103	−.206	−.162	.157	−.025	−.050
	30	−91	−.182	−.143	.298	−.042	−.084
	45	−66	−.132	−.104	.410	−.043	−.086
	60	−37	−.074	−.058	.482	−.028	−.056
	75	−9	−.018	−.014	.511	−.007	−.014
	90	+15	+.030	+.024	.500	+.012	+.024
	105	41	.082	.064	.455	.029	.058
	120	57	.114	.090	.384	.035	.070
	135	69	.138	.108	.297	.032	.064
	150	75	.150	.118	.202	.023	.046
	165	78	.156	.123	.102	.013	.026
	180	81	.162	.127	—	—	—
Compression	195	−78	−.156	−.123	.102	−.013	−.026
	210	−75	−.150	−.118	.202	−.023	−.046
	225	−69	−.138	−.108	.297	−.032	−.064
	240	−57	−.114	−.090	.384	−.035	−.070
	255	−44	−.088	−.069	.455	−.031	−.062
	270	−25	−.050	−.039	.500	−.019	−.038
	285	−9	−.018	−.014	.511	−.007	−.014
	300	0	—	—	.482	—	—
	315	−18	−.036	−.028	.410	−.013	−.026
	330	−81	−.162	−.127	.298	−.038	−.076
	345	−190	−.380	−.298	.157	−.047	−.094

Table II

Stroke	Crank Angle	Press. Per Sq. In. Cylinder	Press. in Percent of Max. P .350 Lbs.	Piston Load, Percent of D^2P	Torque Arm, Percent of Stroke	Turning Moment, Percent of D^2PS	Turning Force D^2PS/r, D^2P
Power	0	261	.745	.585	—	—	
	15	233	.665	.552	.1575	.087	.163
	30	181	.517	.405	.298	.120	.240
	45	130	.372	.292	.410	.119	.239
	60	92	.263	.206	.482	.099	.198
	75	77	.220	.173	.511	.088	.177
	90	75	.214	.168	.500	.084	.168
	105	80	.228	.179	.455	.081	.163
	120	83	.237	.186	.384	.071	.143
	135	86	.246	.193	.297	.057	.114
	150	77	.220	.173	.202	.035	.070
	165	70	.200	.157	.102	.016	.032
	180	67	.191	.150	—	—	—
Exhaust	195	−66	−.189	−.148	.102	−.015	−.030
	210	−64	−.183	−.143	.202	−.029	−.058
	225	−59	−.168	−.132	.297	−.039	−.078
	240	−50	−.143	−.112	.384	−.043	−.086
	255	−36	−.103	−.081	.455	−.037	−.074
	270	−16	−.046	−.037	.500	−.018	−.037
	285	+9	+.026	+.020	.511	+.010	+.020
	300	33	.092	.072	.482	.035	.069
	315	56	.160	.125	.410	.051	.102
	330	73	.209	.164	.298	.049	.098
	345	84	.240	.188	.157	.030	.059
	360	88	.252	.198	—	—	—
Suction	15	−84	−.240	−.188	.157	−.030	−.059
	30	−73	−.209	−.164	.298	−.049	−.098
	45	−56	−.160	−.125	.410	−.051	−.102
	60	−33	−.092	−.072	.482	−.035	−.069
	75	−9	−.026	−.020	.511	−.010	−.020
	90	+16	+.046	+.037	.500	+.018	+.037
	105	36	.103	.081	.455	.037	.074
	120	50	.143	.112	.384	.043	.086
	135	59	.168	.132	.297	.039	.078
	150	64	.183	.143	.202	.029	.058
	165	66	.189	.148	.102	.015	.030
	180	67	.191	.150	—	—	—
Compression	195	−66	−.189	−.148	.102	−.015	−.030
	210	−64	−.183	−.143	.202	−.029	−.058
	225	−59	−.168	−.132	.297	−.039	−.078
	240	−53	−.151	−.118	.384	−.045	−.091
	255	−41	−.117	−.092	.455	−.042	−.084
	270	−26	−.074	−.058	.500	−.029	−.058
	285	−8	−.023	−.018	.511	−.009	−.018
	300	+6	+.017	+.013	.482	+.006	+.012
	315	+6	+.017	+.013	.410	+.005	+.011
	330	−13	−.037	−.029	.298	−.009	−.017
	345	−42	−.120	−.094	.157	−.015	−.029

Table III

Stroke	Crank Angle	Pressure Per Square Inch	Press. in Percent of Max. Press. P	Piston Load Percent Max. Press. × .7854 D^2	Torque Arm Percent of Stroke S	Turning Moment Percent of D^2PS	Turning Force D^2PS/r, $S=2r$
Power	0	212	.707P	.555PD^2	—	—	—
	15	161	.536	.420	.1575	.066	.132D^2P
	30	105	.350	.275	.298	.082	.164
	45	67	.223	.175	.410	.072	.144
	60	50	.167	.131	.482	.063	.126
	75	49	.163	.128	.511	.065	.131
	90	56	.187	.147	.500	.073	.147
	105	64	.213	.167	.455	.076	.152
	120	73	.243	.191	.384	.073	.147
	135	72	.240	.188	.297	.056	.112
	150	67	.223	.175	.202	.035	.070
	165	69	.230	.181	.102	.018	.037
	180	70	.233	.183	—	—	—
Exhaust	195	−69	−.230	−.181	.102	−.018	−.037
	210	−67	−.223	−.175	.202	−.035	−.070
	225	−62	−.207	−.163	.297	−.048	−.097
	240	−52	−.173	−.136	.384	−.052	−.104
	255	−36	−.120	−.094	.455	−.043	−.086
	270	−14	−.047	−.037	.500	−.018	−.037
	285	+11	+.037	+.029	.511	+.015	+.030
	300	33	.110	.086	.482	.041	.082
	315	55	.183	.144	.410	.059	.118
	330	72	.240	.188	.298	.051	.102
	345	82	.273	.214	.157	.034	.067
	360	88	.293	.230	—	—	—
Suction	15	−82	−.273	−.214	.157	−.034	−.067
	30	−72	−.240	−.188	.298	−.051	−.102
	45	−55	−.183	−.144	.410	−.059	−.118
	60	−33	−.110	−.086	.482	−.041	−.082
	75	−11	−.037	−.029	.511	−.015	−.030
	90	+14	+.047	+.037	.500	+.018	+.037
	105	36	.120	.094	.455	.043	.086
	120	52	.173	.136	.384	.052	.104
	135	62	.207	.163	.297	.048	.097
	150	67	.223	.175	.202	.035	.070
	165	69	.230	.181	.102	.018	.037
	180	70	.233	.183	—	—	—
Compression	195	−69	−.230	−.181	.102	−.018	−.037
	210	−67	−.223	−.175	.202	−.035	−.070
	225	−62	−.207	−.163	.297	−.048	−.097
	240	−53	−.177	−.139	.384	−.053	−.107
	255	−41	−.137	−.108	.455	−.049	−.098
	270	−25	−.083	−.065	.500	−.032	−.065
	285	−11	−.037	−.029	.511	−.015	−.030
	300	−1	−.004	−.003	.482	−.001	−.003
	315	−5	−.017	−.014	.410	−.006	−.012
	330	−34	−.113	−.089	.298	−.026	−.053
	345	−92	−.307	−.241	.157	−.038	−.076

Determination of E for Diesel Engines

The curve of the turning efforts is determined from the indicator card with due consideration of the inertia forces of the reciprocating engine parts. Turning effort diagrams of theoretical or prospective engines are subject to the errors of assumptions and the laying-out of the same requires, therefore, experience and good judgment. Diagrams for general application can only be based on average values and should be checked for each design, especially in cases of material departure from the basic assumption.

Ordinary Diesel engines run normally with a mean indicated pressure of about 100 pounds per square inch piston area, the back or compression pressure considered, and this pressure may be taken as the basis of flywheel calculations. The slight variation in pressures during the exhaust and suction strokes of four cycle engines may be ignored. Based on a maximum working pressure, P, of 500 pounds the mean indicated pressure (m.i.p.) is, therefore, 0.2 the maximum pressure or $0.2\,P$. Assuming that the resistance is uniform, the power developed during the power stroke is uniformly consumed during one cycle, which consists of two revolutions for four cycle engines and one revolution for two cycle engines.

If m represents the mean crank pin pressure per square inch of cylinder area and r length of crank in feet, then $2r =$ stroke S of engine and

$$.2P \times 2r = m \times 2r\pi \times 2$$
$$m = .0318\ P \text{ (4 cycle 1 cylinder)}$$
$$.2P \times 2r = m \times 2r\pi;$$
$$m = .0636\,P \text{ (2 cycle 1 cylinder)}.$$

The mean turning force relative to the crank circle is

$$.0318\,P \times .7854\ D^2 = .025\ D^2P \text{ (4 cycle 1 cylinder)}$$
$$.0636\,P \times .7854\ D^2 = .050\ D^2P \text{ (2 cycle 1 cylinder)}$$

wherein $D =$ diameter of cylinder in inches.

The above mean indicated cylinder pressure is based on the net output of the cylinder. The work done during the power stroke covers, in addition to the uniform propeller resistance, the resistance of the compression stroke. The mean indicated pressure of the latter varies between 40 and 50 pounds per square inch of cylinder area. Taking an average of 45 pounds, the total mean indicated pressure of the power stroke is $100 + 45 = 145$ pounds and the equivalent mean crankpin pressure m during this stroke $145 \times 2r = m \times r\pi$;

$$m = 290/\pi = 92.35 \text{ pounds} = .185\,P.$$

The mean turning force of the power stroke is

$.185\,P \times .7854\,D^2 = .145\ D^2P$ for 4 and 2 cycle engines and the total work done during this stroke based on the crank path

$\left(r\pi = \frac{S}{2}\pi\right)$ is $.145\,D^2P \times \pi S/2 = .228\,D^2PS$.

The uniform resistance of $.025\,D^2P$ (4 cycle) covers a mean length of $.965$ of the power stroke area or $.965\,\pi S/2$ and its work is

$$.025\,D^2P \times .965\,\pi\,S/2 = .038\,D^2PS$$

leaving an excess power

$$E = (.228 - .038)\,D^2PS = .190\,D^2PS \text{ (4 cycle 1 cylinder)} \quad (4).$$

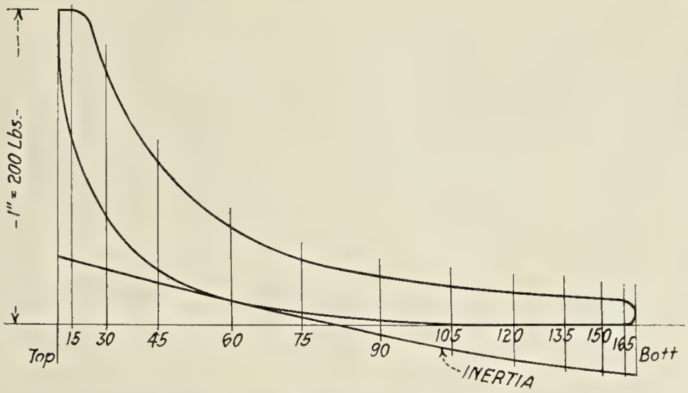


Fig. 3.—Maximum Initial Pressure, 300 Pounds=P; Mean dicated Pressure, 100 Pounds; Mean Compression Pressure, 45 Pounds

The uniform resistance of $.050\,D^2P$ (2 cycle) covers a mean length of $.935$ of the power stroke arca or $.935\,\pi S/2$ and its work is

$$.050\,D^2P \times .935\,\pi\,S/2 = .073\,D^2PS$$

leaving an excess power

$$E = (.228 - .073)\,D^2PS = .155\,D^2PS \text{ (2 cycle 1 cylinder)} \quad (5).$$

E DETERMINED FROM TORQUE DIAGRAMS FOR DIESEL ENGINES

In multi-cylinder engines the work performed by each cylinder is of equal magnitude and the above noted mean

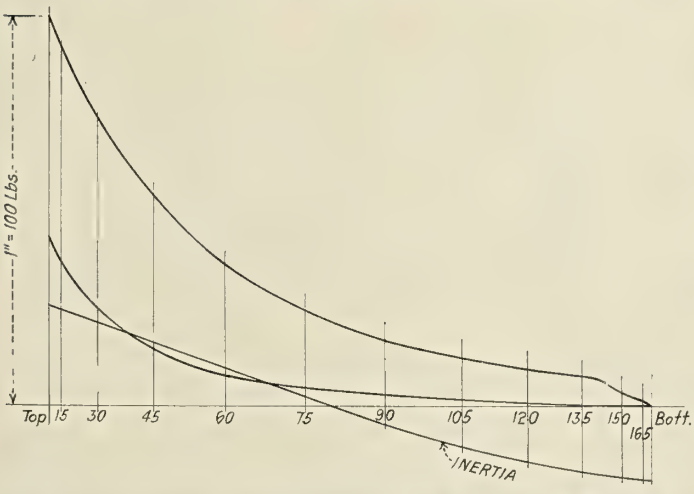


Fig. 2.—Maximum Initial Pressure, 350 Pounds=P; Mean Indicated Pressure, 75 Pounds; Mean Compression Pressure, 25 Pounds

turning efforts of one cylinder may be multiplied by the number of cylinders in order to obtain the combined mean turning effort. It is, however, much easier to determine the excess power by planimetering the excess power area of torque diagrams.

The indicator card in Fig. 1 has the mean pressures above referred to as basic assumptions and the various readings of this card are tabulated in Table I. The torque arm (sixth column) has been determined by the graphical method, described in the author's article in MARINE ENGINEERING AND SHIPPING AGE of April, 1922. The connecting rod/crank length ratio of 4.5 has been used in this analysis as representing the average practice. The seventh column contains the turning moments, being the product of the piston load and the torque arm at the respective crank angle. The last column contains the turning force, i.e., the turning moment divided by the crank length, r. The accuracy of the measurements of the card may be checked by summing the values in the last column and dividing by the total number of crank positions. For a four cycle engine (1 cylinder) the average of the 4 strokes should be $.025\,P\,D^2$ and for the two cycle engine (1 cylinder) $.050\,P\,D^2$ in accordance with the results arrived at above mathematically.

The turning effort diagrams of 4 and 2 cycle engines are shown on Charts 1 and 2 as noted. The abscissæ represent the crank angles for one complete cycle, 2 revolutions for the 4 cycle engine and one revolution for the 2 cycle engine, having one cylinder. The ordinates represent the turning forces at the various crank angles, as given in the last column of Table I. For multi-cylinder engines one complete cycle is covered by the crankpath of $720/n$ degrees in

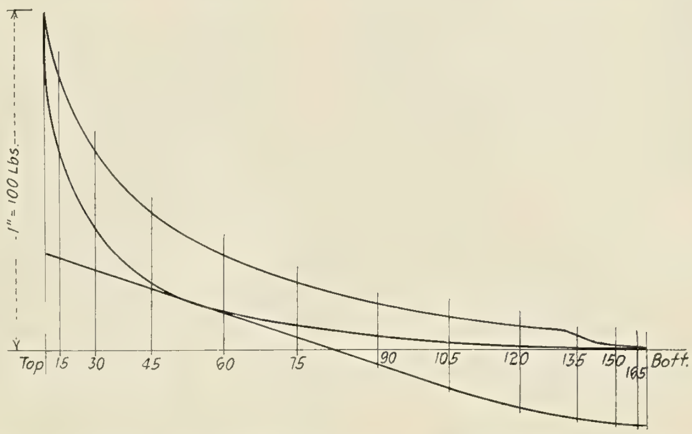


Fig. 3.—Maximum Initial Pressure, 300 Pounds=P; Mean Indicated Pressure, 35 Pounds; Mean Compression Pressure, 32 Pounds

the case of 4 cycle engines and by $360/n$ in the case of 2 cycle engines where n = number of cylinders. Thus a complete diagram of a 6 cylinder 4 cycle engine may be shown on a diagram of $720/6 = 120$ degrees; the turning forces in PD^2 (column 8 Table I) of the various cranks must be combined in their proper relation; i.e., the efforts of 30—150—270—30—150—270 will fall on the same abscissa, marked 30.

The mean turning force line divides the curve into two equal parts, the areas above the mean line are equal to the areas below. Its height above the zero torque line, represents the force in terms of D^2P. Multiplied by the length in terms of $\pi S/2$ gives the work done during one cycle. Thus $.025\,D^2P \times 2r\pi \times 2 = .157\,D^2PS$ is the work of one cycle of a 4 cycle one cylinder engine, and $.050\,D^2P \times 2r\pi = .157\,D^2PS$ is the work of one cycle of a 2 cycle one cylinder engine.

In order to avoid confusion, the curves of the turning efforts of the individual cylinders have been omitted on the diagrams for engines with a large number of cylinders and the resultant curves, shown in heavy lines, have been obtained by adding the proper values in the last column of Table I. The excess energy of the power stroke is the shaded area marked E above the mean turning force line. Its area has been determined by multiplying the mean height

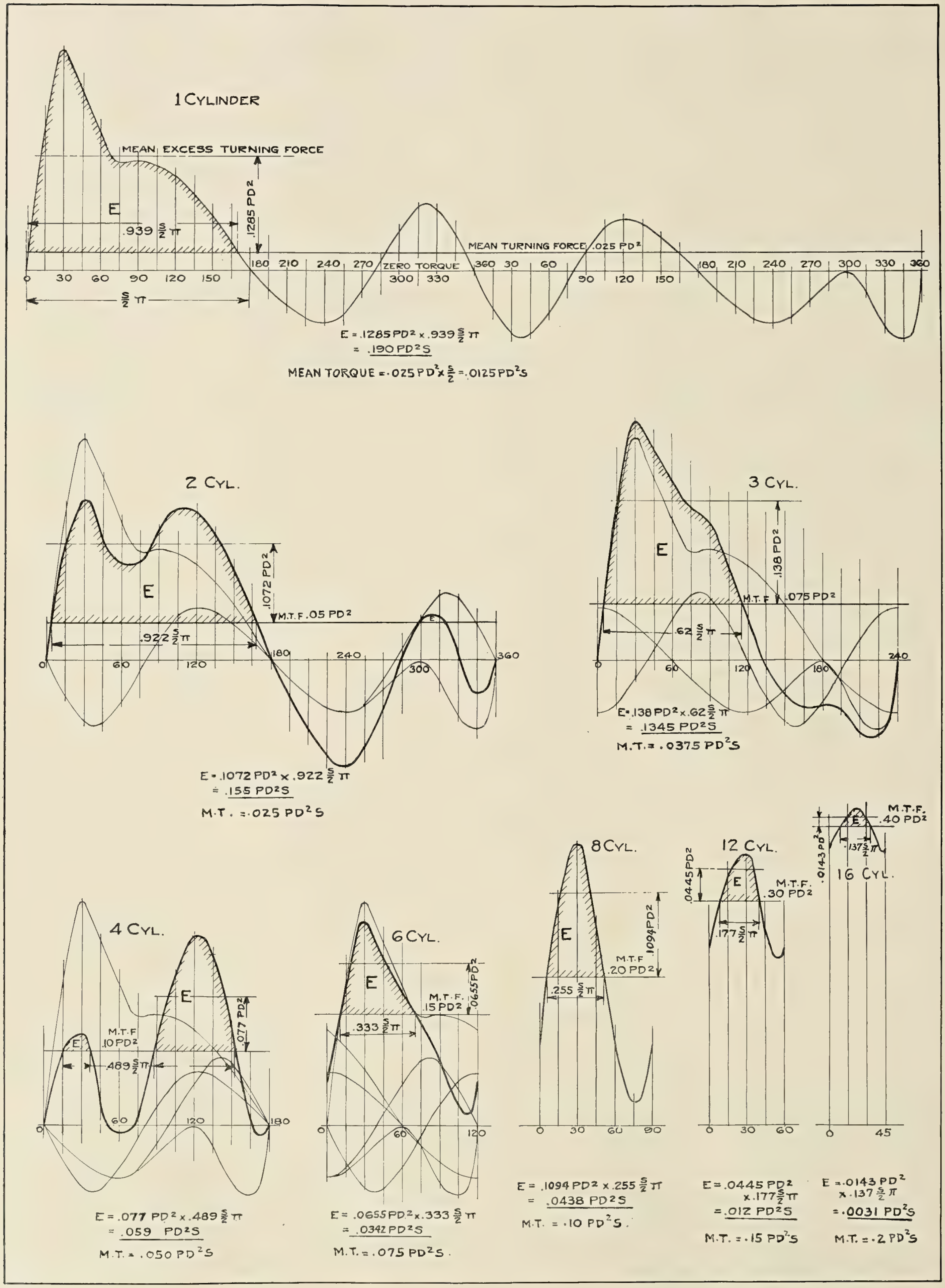


Chart 1.—Turning Effort Diagrams. Four Cycle Diesel Engines

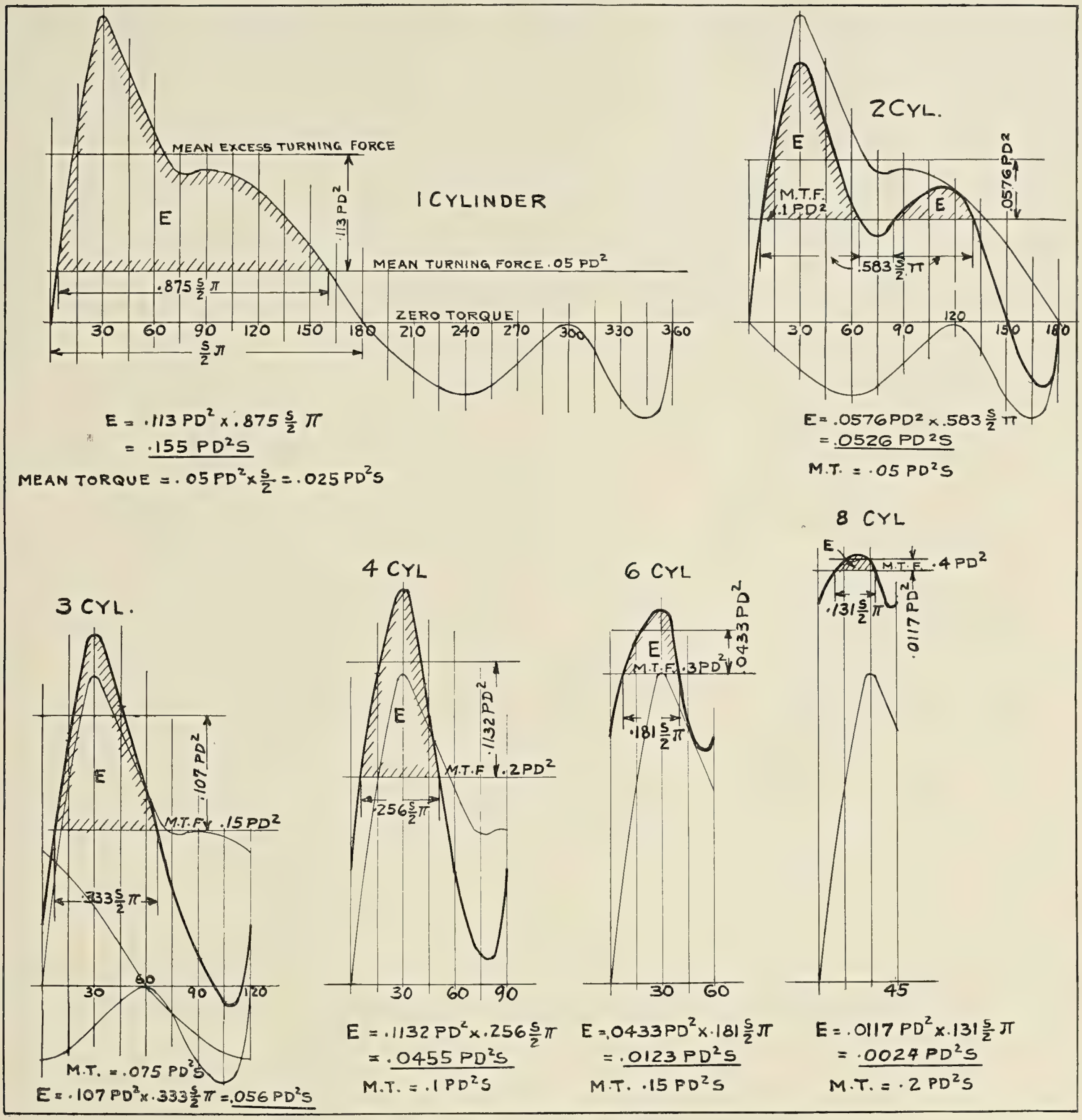


Chart 2.—Turning Effort Diagrams. Two Cycle Diesel Engines

in terms of the piston load PD^2 by the length in terms of the crankpath $S/2\pi$, the product being a percentage of D^2PS or KD^2PS. For general application refinement in the use of the excess area values E is out of order in view of the fact that varying compression and inertia may change the same to a minor degree and the values of K given in the following table may be considered a fair average, being the actual values noted on the charts rounded upwardly, i.e., on the safe side.

Values of K for Diesel Engines

No. of Cylinders	1	2	3	4	6	8	12	16
4 cycle	.190	.155	.135	.060	.040	.045	.015	.005
2 cycle	.155	.055	.055	.045	.015	.005	....	....

By substituting KD^2PS for E in formula 3 the main formula for flywheel effect is obtained

$$KD^2PS = W\ C\ F^2\ R^2 \quad (6)$$

from which the fluctuation C for any existing flywheel or the diameter and weight ($W\ F$) of the flywheel for a desired fluctuation may be determined for any Diesel engine.

Determination of E for Explosive Combustion Engines

The mean indicated and the mean compression pressures for engines other than Diesel type cover a much wider range than those for Diesel engines. The considerable difference is plainly shown by the two indicator cards, Fig. 2 and Fig. 3, the former having a mean indicated pressure of 75 pounds and the latter of 35 pounds, which pressures are not the extreme limits. It is not the scope of this article to discuss the causes and effects of this wide difference in the design of explosive combustion engines. For the purpose of establishing the values of E for the required flywheel effect it is considered advisable to use Fig. 2, which gives

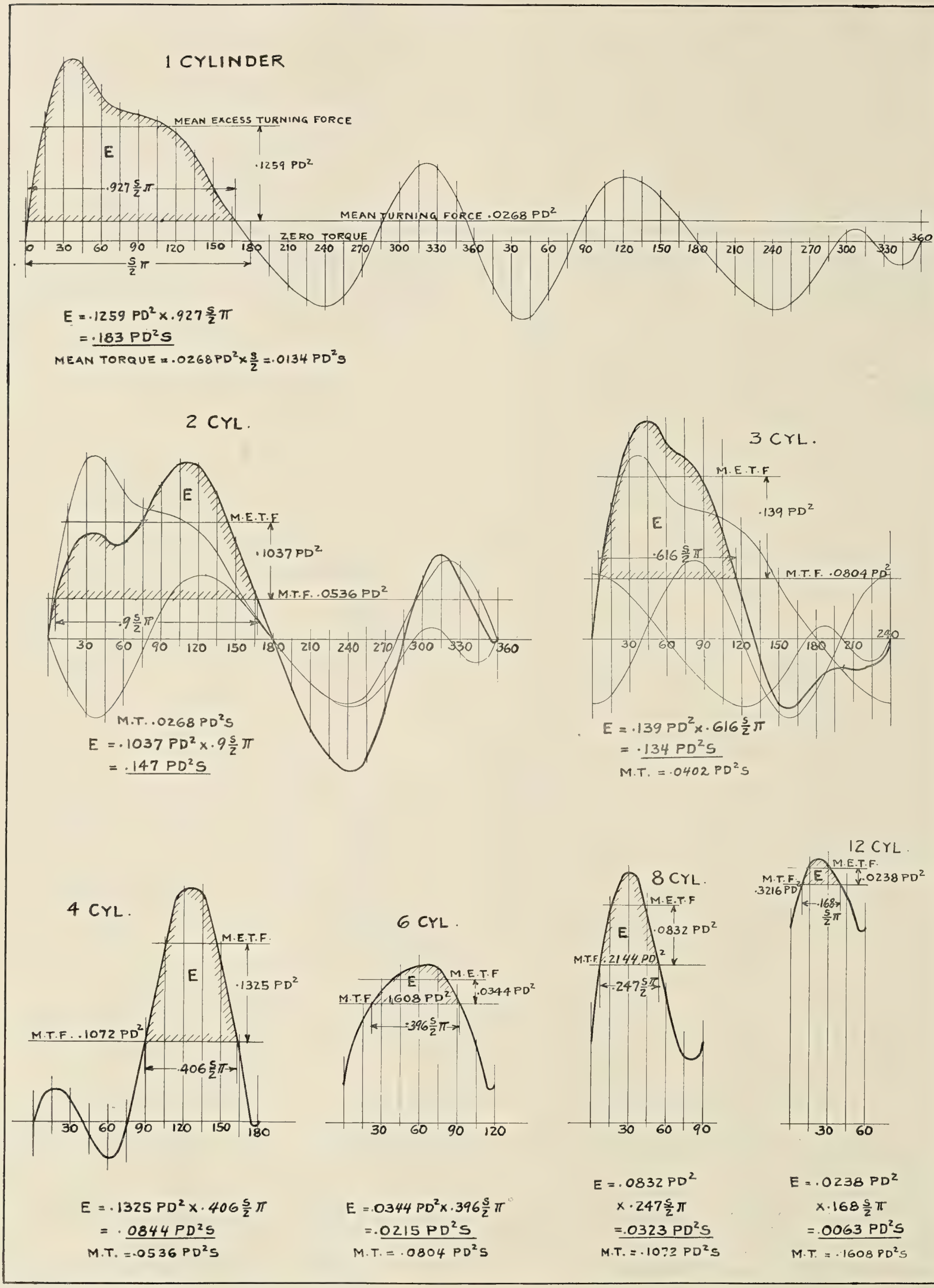


Chart 3.—Turning Effort Diagrams. Four Cycle Explosive Combustion Engines

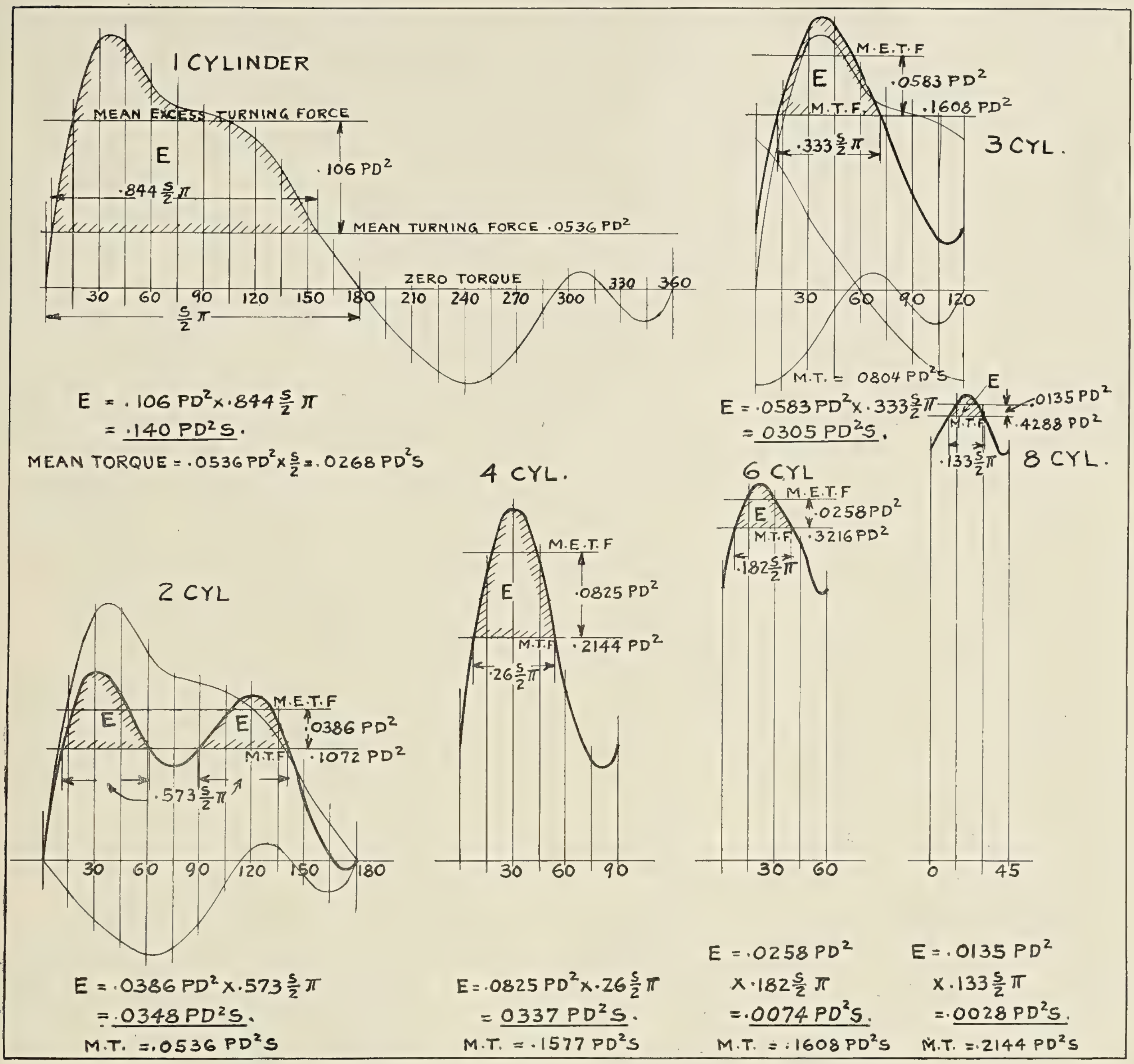


Chart 4.—Turning Effort Diagrams. Two Cycle Explosive Combustion Engine

somewhat larger values. Using the data given in Table II and Fig. 2 the excess area E for one cylinder engines are here briefly analyzed.

Maximum initial pressure P = 350 pounds.
Mean indicated pressure 75 pounds.
Mean compression pressure 25 pounds.
Mean power stroke pressure 75 + 25 = 100 pounds.
Mean crankpin pressure =

$$\frac{75 \times 2r}{2 \times 2r\pi} = 11.94 \text{ pounds} = .0341\ P \text{ (4 cycle)}$$

Mean crankpin pressure =

$$\frac{75 \times 2r}{2r\pi} = 23.88 \text{ pounds} = .0682\ P \text{ (2 cycle)}$$

Mean turning force =

$$.0341\ P \times .7854\ D^2 = .0268\ PD^2 \text{ (2 cycle)}$$

Mean turning force =

$$.0682\ P \times .7854\ D^2 = .0536\ PD^2 \text{ (2 cycle)}$$

Mean crankpin pressure during power stroke =

$$\frac{100 \times 2r}{r\pi} = 63.7 \text{ pounds} = .182\ P$$

Mean turning force during power stroke =

$$.182\ P \times .7854\ D^2 = .1427\ PD^2$$

The excess work of the power stroke =

$$(.1427 - .0268)\ PD^2 \times \frac{S}{2}\pi = .183\ D^2PS \text{ (4 cycle)} \qquad (7)$$

$$(.1427 - .0536)\ PD^2 \times \frac{S}{2}\pi = .140\ D^2PS \text{ (2 cycle)} \qquad (8)$$

E Determined from Torque Diagrams for Explosive Combustion Engines

In the same manner as described under Diesel engines the turning efforts of the indicator card Fig. 2 and Table II, are shown on Charts 3 and 4, for four cycle and two cycle engines. The following table gives the round figures for values of K which may safely be used to calculate the flywheel effect in connection with formula 6.

Values of K for Explosive Combustion Engines

No. of Cylinders	1	2	3	4	6	8	12
4 cycle	.180	.150	.135	.090	.030	.035	.010
2 cycle	.150	.045	.035	.035	.010	.003	....

Effect of Varying Fluctuation on Diameter of Line Shafting

It has been previously stated that the power developed during the power stroke is uniformly absorbed by the propeller. Were it possible for an engine to have a flywheel of sufficient size and weight to absorb all the excess power of the power stroke the fluctuation would be zero and the shaft would be designed for uniform torque. But a glimpse at formula 6 will show the impossibility inasmuch as a zero torque will require a flywheel of an infinite diameter $\times$ weight. The uniform torque may, however, be used as a starting point from which shaft diameters for varying fluctuations can be calculated and the basic formula for this condition is

Shaft torque modulus $\times$ fibre stress = uniform (mean) torque. If d = diameter of shaft and the fibre stress = 5,000 pounds per square inch, $.196\ d^3 \times 5{,}000$ = *uniform torque.*

The uniform torque is the mean turning force noted on the diagrams multiplied by the length of the crank $S/2$. Thus for a 3 cylinder 4 cycle Diesel engine

$$.196\ d^3 \times 5{,}000 = .075\ PD^2 \times S/2 = .0375\ PD^2S$$

$$d = \sqrt[3]{\frac{.0375\ PD^2S}{.196 \times 5{,}000}} \qquad (9)$$

But uniform torque T implies uniform velocity. Energy, however, increases as the increase in velocity squared. The increase in velocity is equal to one-half the fluctuation C as noted in the section on speed fluctuation. If the velocity for uniform torque T is unity, the total torque T_1 for any increase in velocity $= T\ (1 + C/2)^2$. For example, $C = .1$, $T_1 = T\ (1 + .05)^2 = 1.1T$ (nearly). Within the practical limits of C, $(1 + C/2)^2$ is nearly equal to $(1 + C)$ and it will be sufficiently correct to make $T_1 = T(1 + C)$.

Continuing the example of formula (9) for a fluctuation $C = .1$ the torque $.375\ P D^2S$ is increased to $1.1 \times .0375\ P D^2S = .0413\ P D^2S$ and

$$d = \sqrt[3]{\frac{.0413\ P\ D^2S}{.196 \times 5{,}000}} = .595\ \sqrt[3]{\frac{D^2PS}{5{,}000}} \qquad (10)$$

The value under the cube root sign is a constant applicable to engines with any number of cylinders and the numerical value before the root sign a variable depending on the number of cylinders, the cycle, and the fluctuation. It is advisable to retain the fibre stress = 5,000 in the formula in order to permit the ready insertion of a higher or lower stress, depending whether a material of a better or of an inferior quality than the ordinary marine steel of 60,000 pounds minimum tensile strength is used. For material having a minimum tensile strength of 70,000 pounds 5,300 may be used in the place of 5,000. Denoting the variable factor as "b" the formula takes the general form of

$$d = b\ \sqrt[3]{\frac{D^2PS}{5{,}000}}$$

The value "b" may be tabulated as shown in Table IV.

Table IV

Values of b for Diesel Engines

No. of cylinders									
4 cycle	1	2	3	4	6	8	12	16	..
2 cycle	..	1	..	2	3	4	6	8	12
$C = 0$; $T_1 = T$......	.399	.503	.576	.635	.726	.799	.915	1.007	1.153
$C = .05$; $T_1 = 1.05\ T$	.406	.512	.586	.645	.738	.812	.930	1.023	1.172
$C = .1$; $T_1 = 1.1T$...	.412	.520	.595	.655	.750	.825	.944	1.038	1.191
$C = .15$; $T_1 = 1.15\ T$	.419	.528	.604	.665	.761	.837	.958	1.053	1.208

For values of b for intermediate fluctuations it will be sufficiently correct to interpolate between the values given, but it will be more accurate to determine T_1 and solve for b in accordance with formula 10.

In a similar manner tables of b values may be calculated for explosive combustion engines, but on account of the wide difference in the mean indicated pressures, which would necessitate a number of tables for engines of different characteristics another method of calculating shaft diameters applicable to all engines is given in the following—

General Formula for Determination of Line Shaft Diameters

p = Mean indicated pressure (from indicator card or by design).
p_c = Mean turning pressure (crankpin).
r = Length of crank in inches; stroke $S = 2r$.
D = Diameter of cylinders in inches.

$$p \times 2r = p_c \times 2r\pi \times 2$$
$$p_c = .16p \text{ (4 cycle)}$$
$$p \times 2r = p_c \times 2r\pi$$
$$p_c = .32p \text{ (2 cycle)}$$

Mean turning force =
$$.16\ p \times .7854\ D^2 = .125\ p\ D^2 \text{ (4 cycle)}$$
Mean turning force =
$$.32\ p \times .7854\ D^2 = .25\ p\ D^2 \text{ (2 cycle)}$$
Mean turning moment =
$$.125\ p\ D^2 \times S/2 = .0625\ p\ D^2S \text{ (4 cycle)}$$
Mean turning moment =
$$.25\ p\ D^2 \times S/2 = .125\ p\ D^2S \text{ (2 cycle)}$$

Torsional resistance of shaft with fibre stress of 5,000 pounds per square inch =
$$.196\ d^3 \times 5{,}000$$

For 1 cylinder 4 cycle
$$.196\ d^3 \times 5{,}000 = .0625\ p\ D^2S.$$
$$d = \sqrt[3]{\frac{.0625\ p\ D^2S}{.196 \times 5{,}000}} = .683\ \sqrt[3]{\frac{p\ D^2S}{5{,}000}}$$

For 1 cylinder 2 cycle
$$d = \sqrt[3]{\frac{.125\ p\ D^2S}{.196 \times 5{,}000}} = .861\ \sqrt[3]{\frac{pD^2S}{5{,}000}}$$

The torque produced by each cylinder of multi-cylinder engines is of equal magnitude and the value under the cube root may be multiplied by the number of cylinders, N, in order to obtain the combined mean torque;

Thus for 4 cycle engines
$$d = .683\ \sqrt[3]{\frac{pD^2SN}{5{,}000}}$$

The torque varies as the square of the speed. Shafts are designed for maximum torque and the increase in torque T due to the speed fluctuation above normal is

$$T \times \left(\frac{C}{2}\right)^2$$

and the total torque T_1 for any fluctuation $= T(1 + C/2)^2$.

For example: For $C = .1$ the excess speed $= .05$ and the corresponding torque $T_1 = T \times 1.05^2 = 1.1\ T$ (nearly).

Within the customary limits of speed fluctuations C it will suffice to multiply the mean torque value under the cube root sign by $(1 + C)$ in order to obtain the maximum torque T_1.

The final formula will then read:—

For 4 cycle engines
$$d = .683\ \sqrt[3]{\frac{p\ D^2\ S\ N}{5{,}000}} \qquad (11)$$

For 2 cycle engines
$$d = .861\ \sqrt[3]{\frac{p\ D^2\ S\ N}{5{,}000}} \qquad (12)$$

It will be noted that p is based on the indicated power and not on the brake power. In view of the many extraordinary conditions which may occur in the operation of internal combustion engines it is considered advisable to retain this margin of safety. For engines designed for considerable overload a liberal percentage of the overload mean indicated pressure should be considered in the calculations for shaft sizes.

Shafts calculated by these formulæ are considered subject to torque only, such as line shafts. Shafts subject to bending stress in addition to torque, such as for generators, pumps, etc., should be calculated for the equivalent bending moment by the well known formula

$$M e = .35\ B + .65\ \sqrt{B^2 + T^2}$$

Wherein

Me = Equivalent bending moment.
B = Bending moment = $WL/6$.
L = Distance in inches between centers of bearings.
W = Weight, carried by shaft in pounds.
T = Twisting moment, (or T_1) derived as shown above.

The modulus of resistance for bending is $.098\ d^3 \times 5{,}000$.

$$.098\ d^3 \times 5{,}000 = .35\ B + .65\ \sqrt{B^2 + T^2}$$

and

$$d = \sqrt[3]{\frac{.35\ B + .65\ \sqrt{B^2 + T^2}}{.098 \times 5{,}000}}$$

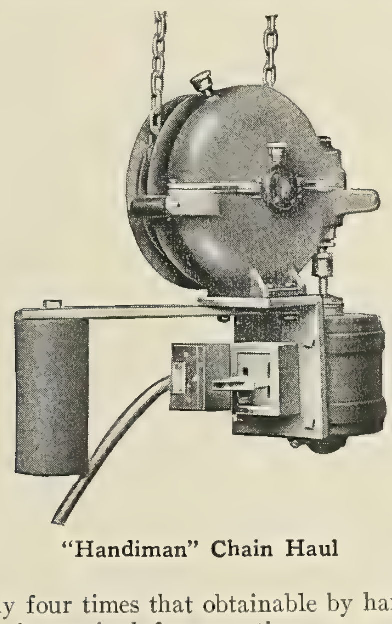
$$= .128\ \sqrt[3]{.35\ B + .65\ \sqrt{B^2 + T^2}} \quad (13)$$

The fibre stress of 5,000 pounds per square inch represents the regular marine steel of 60,000 pounds tensile strength; where material of 70,000 pounds tensile strength is used, 5,300 may be substituted for 5,000.

The author takes this opportunity to express his appreciation for the kind cooperation of the engine builders, notably Worthington Company, McIntosh-Seymour, Standard Motor Construction Company and others to a lesser degree, by placing valuable data at his disposal.

Electric Chain Haul for Hand Hoists

AN electric machine now manufactured by the New Jersey Foundry and Machine Company, 90 West street, New York, will be of interest to users of hand power hoists of 5 tons and larger capacity. This machine may be suspended in the bight of the operating chain and will overhaul 128 feet of hand chain per minute and give a chain a pull of 130 pounds. This permits a load lifting speed of approximately four times that obtainable by hand power and but one man is required for operating.



"Handiman" Chain Haul

Current is supplied to the unit by a flexible conductor attached to convenient sockets or it may be suspended from the hoist if it is more desirable to bring the feeders to that point. The machine is self-balancing, weighs about 160 pounds and can be furnished for operation on either alternating or direct current. Hardened gears are used throughout running in an oil bath.

Public Health Service Requirements for a Sanitary System of Drinking, Cooking and Ablutionary Water Supplies on Vessels

ALL vessels engaged in interstate traffic or handling passengers traveling interstate, or freight which is being transported interstate, are subject to the Interstate Quarantine Regulations of the United States. Special requirements have been prepared for the supervision of the water supplies used for drinking and culinary purposes on such vessels, subject to these regulations. In order that unnecessary and expensive changes, often requiring delay of vessels from their regular business, may be avoided, the following information is herewith prepared for the guidance of naval architects and the managing officials and designing engineers of shipbuilding and repairing companies.

1. If water for drinking and culinary purposes is to be taken by the vessel en route from overboard, it will be necessary that a system of purification be provided, which is satisfactory to the United States Public Health Service. Your attention is invited to page 25, Interstate Quarantine Regulations of the United States, relating to this matter.

2. The storage of water on the vessel for drinking and culinary purposes, either when purified aboard or taken from approved supplies ashore, shall be in tanks of adequate capacity for the needs of the passengers and crew; all tanks shall be of such design that they can be readily and completely drained and flushed, and that the water contained therein will be kept free from exposure to contamination. All possible points where leakage may occur shall be eliminated or designed so as to reasonably minimize the possibility of leakage. The covers of all openings into the tanks shall be watertight.

3. The filling arrangement to such tanks should be so installed as to make it unnecessary that large manholes and other openings be kept uncovered. A small filling pipe provided with a cap should be provided for the purpose of filling the tanks.

4. There shall be no physical connection whatever between the drinking water tanks, pipes, pumps or any part of the system and any other water system on the vessel, or to the sea-cock, bilge pump, fire pump or boiler feed supply (if other than the drinking water is ever used for this latter purpose).

5. The use of storage tanks, containing drinking or culinary water, built in the fore and aft parts of a vessel by placing a bulkhead across the ship and allowing the hull to form part of the tank is strongly discouraged, because such tanks are difficult of access and in case of leakage are subject to potential contamination.

6. In no case shall soil pipes from water closets or drainage pipes of any kind pass through storage tanks containing water for drinking and culinary purposes.

7. There should be no water connections in the kitchens whereby it may be possible to draw water from any but the drinking and culinary water supply.

8. All spigots, faucets or connections whereby it is conveniently available to draw water from other than the regular drinking water supply on board the vessel shall be posted with permanent signs warning that the water is not safe for drinking.

9. Arrangements should be made for the cooling of drinking water on the vessel so that there can be no contact between the water and the cooling ice. This can be most conveniently accomplished by the use of coils in the ice chest.

10. The use of lead pipe in connection with the drinking water system on board the vessel is prohibited.

A. W. MELLON, *Secretary.*

Packing and Gaskets for Shipbuilding Purposes

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

ON account of the variety of materials and combinations of materials that are made up into packings and gaskets of various kinds and also because of the fact that in most cases packings and gaskets are selected as a result of their past performance rather than on account of the materials of which they are made, the principal value of any article on this subject is the presentation of certain fundamental rules governing the selection of such products.

For past performance, which is so important a factor, the shipbuilder, operator or designer has resort to a number of channels of test and experience in addition to his own accumulated knowledge. One of the most valuable of these is the United States Navy Department, which has lists of approved packings for all of the most important uses. These are subject to change from time to time as new products are tested out and found to be up to standard requirements.

Packings and gaskets are one and the same thing from the point of view of the materials of which they are made and the purpose for which they are used. As purchased, they are all packing except when ordered made up to size and shape for making tight joints between stationary parts, in which case they are called gaskets. As used, the strips or forms of material, cut from sheet packing or otherwise, are called gaskets, except when inserted in stuffing boxes and similar packing spaces in way of moving parts, in which case they are called packing. There are metallic, semi-metallic and "soft" or fabric packings and gaskets and their nature and use can be best shown by dealing with them under the headings of Packing of Moving Parts, Packing of Stationary Parts, Boiler Gaskets and Miscellaneous Packings.

Packing of Moving Parts—Packings

Assembled Metallic Packing

An assembled packing consisting of a container which fits into or against the stuffing box, metal wearing rings, springs to keep the rings against the rod and any other necessary parts, is usually designated merely as metallic packing and is assumed to be required where "metallic packing" is specified on shipboard. Such a packing is the standard for high pressure piston rods and valve rods of reciprocating steam engines. On account of its flexibility it is especially desirable where there is a lack of alinement throughout the length of the stroke. The packing rings are of cast iron or bearing metal, or a combination of both. When properly cared for, the rods are not subject to as much friction and wear as with the so-called soft packings, and the metallic packing is less expensive in the long run.

This packing is particularly desirable for the main engines, the steam end piston rod of main and auxiliary boiler feed pumps, and the piston rod of circulating pump and independent air pump engines. Representative packings of this kind are the Cook, France, Holmes, Katzenstein, Martel, Mitchell, United States and Watson packings.

The writer knows of no assembled metallic packing that will hold water or ammonia without the use of a ring or two of soft packing.

Metallic Packing, Miscellaneous

There are various metallic packings on the market which consist of rings of bearing metal of various shapes and cut in various ways so as to break the joints. They are cheap substitutes for the assembled metallic packing and are of no value for severe duty. They are of value in some cases on small rods and have less friction and cause less wear on the rods than some of the soft packings. They generally require one or more rings of soft packing to make a tight joint and such combinations are proposed for certain services by their manufacturers.

Semi-Metallic Packing

Such packings are usually of bearing metal or lead braided, shredded or in the form of shot. In some cases graphite is mixed with the metal, and in other cases the lead and graphite are made plastic by the addition of bismuth. From their nature they might be called metallic packing, but it is safer to class them as semi-metallic.

They are generally found to be unsatisfactory when used for either rods or slip joints. They melt into a hard, solid mass, frequently leak and are difficult to remove when it becomes necessary to renew them or replace them with some other form of packing.

These packings require one or more rings of soft packing when used to hold water, air or ammonia.

Some of the manufacturers of soft packings produce products which contain bearing metal in combination with other materials, and this is another type of semi-metallic packing. They also produce a braided soft copper wire packing, to be used in combination with fibrous packings for high pressure work.

Soft Packing

Non-metallic packings for the service now under consideration are called soft packing. Their name is legion and their composition and construction very diverse. There are however certain fundamental considerations from a materials point of view which are of value in making a proper selection for any particular service. The packing should be resilient and flexible and retain these qualities under the service conditions, and it should not be of a construction that will allow pieces of it to get loose and work away. Asbestos is the premier material for high heat and is a valuable packing material generally; but it is deficient in elasticity. Rubber gives resiliency but dry heat and oil destroy it. Hemp is too coarse. Cotton is soft and elastic but will not stand heat. Flax is very flexible, but expensive, and will not stand heat.

The most satisfactory soft packings for severe high heat steam service or air service consist of combinations of carefully treated long fiber asbestos which is lubricated with graphite and various compounds, with a rubber cushion that is usually near the back of the packing. Some of these packings which have been found to give good service on shipboard are:

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

Anchor Packing Company	Ankorite Superheat No. 205
Belmont Packing & Rubber Company	Belmont No. 50
Consolidated Packing & Supply Company	Consolidated No. 306
Crandall Packing Company	Helios No. 303
Garlock Packing Company	Garlock No. 150
H. W. Johns-Manville Company	Kearsarge No. 165

For medium or low pressure steam service the cotton duck and rubber packings are satisfactory.

For packing around the stems of valves and similar service braided or twisted asbestos rope packings are satisfactory, but such packings have only a short life around high pressure rods or in steam line slip joints.

Ammonia rods require a specially expansive and resilient packing and in some cases pure rubber rings are used in combination with other packings. For expander and compressor rods some lubricated combinations of rubber and duck have been found satisfactory, such as

Belmont Packing & Rubber Company	Belmont No. 103
Goodyear Tire & Rubber Company	Lubricated Ammonia

This kind of packing will give trouble in case of overheating.

For gas, gasoline and oil, braided asbestos lubricated packings are suitable. Woven flax packings are also satisfactory for cold oil. For inside packed oil pistons the special hydraulic packing referred to under the head of water packings is used.

For cold water and brine service such as pump plungers and rods, stern tube and pipe line stuffing boxes, etc., flax packings are the best. Tucks packing, which is the name for a cotton duck and rubber combination made by a number of the manufacturers, is also good for pump plungers and rods. Alternate rings of square flax and round Tucks packing have been found to give long service in feed pump plungers.

For hot water service the duck and rubber packings as used for medium and low pressure steam are suitable.

Inside packed pistons call for a specially hard durable packing that will not swell from absorption of water, and for this service a packing made of layers of closely woven duck held together with a fine grade of white rubber has been found most suitable. It goes by the name of "hydraulic packing."

For centrifugal pump stuffing boxes and other revolving shaft work, a braided asbestos lubricated packing such as "Palmetto" made by Greene, Tweed & Company has been found to give very good results.

Cotton lamp wicking is of value for cold water service around valve stems.

Packing of Stationary Parts—Gaskets

Gaskets cut from sheet packing are required mainly for cylinder covers and in pipe lines and valve bonnets. They generally range from 1/32 inch to 1/16 inch thick. For steam up to 125 pounds pressure and for water of all pressures 1/32 inch will usually suffice. For steam from 125 to 250 pounds and for oil 1/16 inch is a good thickness. In some cases such as fuel oil suction and oil filling lines gaskets for oil tight work are made ⅛ inch thick of compressed cardboard. Good practice for the gaskets between component parts of pumps, condensers and feed water heaters is to specify a thickness of not less than 1/32 inch nor more than 1/16 inch, and for evaporators and distillers, a thickness of not less than 1/16 inch nor more than ⅛ inch.

Metallic

The metallic gaskets most frequently met with on shipboard are the sheet lead gaskets used about the refrigerating plant installation. Soft copper or lead wire rings are required between the stuffing box and the gland with certain types of assembled metallic packing. The copper is preferable

Compressed Asbestos Fiber

Gaskets of this material are the best for all high heat service including cylinder head joints of steam and internal combustion engines. The asbestos fiber is compressed under great pressure with bonding materials. In some cases one side of the packing is graphited or otherwise treated so that it will not adhere to the joint surface, and the other treated so that it will adhere, thus preventing destruction of the gasket when the joint is taken apart. This results in the two sides being of different colors.

Examples of these sheet packings, or gasket materials, which have given good satisfaction on shipboard are:

Anchor Packing Company	Ankorite No. 425 and Tauril
Consolidated Packing & Supply Company	Consolco No. 500
Crandall Packing Company	Rex Style No. 1920
Durabla Manufacturing Company	Durabla
Garlock Packing Company	No. 900
Goodrich Company	Special Black
Goodyear Tire & Rubber Company	Goodyearite
H. W. Johns-Manville Company	Service Sheet
Johns-Pratt Company	"Red Fibre"
New York Belting & Packing Company	Firo

Woven Asbestos Cloth

This packing is an asbestos fabric with fine brass wire interwoven and impregnated with a special compound. It is an expensive high heat sheet packing that is not as efficient as the compressed asbestos fiber packing. It is necessary where the joint surfaces are rough and uneven. It is particularly suitable for such service as exhaust pipe header flanges. The Johns-Manville Company's "Mobilene" is an example of this kind of packing.

Rubber

Rubber is the ideal gasket material for watertight work about the hull, in watertight doors, manholes, etc., and for washers generally. It cannot, however, be used where oil or gasoline might come in contact with it; so is not suitable for manholes of double bottoms that may carry oil and similar service.

Pure rubber rings are also the approved gaskets between the tail shaft liner and the propeller hub to keep water out of the propeller cavity.

Rubber gaskets are also used in ammonia joint work.

Rubber Compositions

These are of particular value where the leakage of water or brine is to be prevented. They can be obtained plain or with cloth or wire insertion, which add to the life and strength of the packing. Like pure rubber, such packings will not in general stand exposure to heat, oil or gasoline.

The cloth insertion packing is usually furnished in two grades. Grade No. 1 is expensive and is intended for use only in joints which may be expected to last for years. Grade No. 2 is a high-grade packing costing about one-third as much as Grade No. 1 and should be used for all ordinary purposes.

The wire insertion packing should be limited to hot water and low pressure steam joints. High pressure steam gradually burns it out. It is very expensive and in most cases some other type of packing should be used. It is customary on hot water pumps to have the same kind of gaskets on both the steam and water ends.

Examples of rubber composition packing, which have been found satisfactory are:

U. S. Rubber Company	"Rainbow"
B. F. Goodrich Company	"Akron Red Sheet"

Some packings of this character soon crack and deteriorate in a store room.

Wood Fiber

Wood fiber sheet packings are made to resist oil, gasoline and water. They contain no rubber or rubber substitutes

that are soluble in oil or gasoline. Tough oiled paper is an example of thin packing of this kind. Cardboard cut to shape without joint and soaked in a mixture of 10 parts varnish and 20 parts wax makes good gaskets for oil tank manholes. Proprietary packings that have given good service on shipboard are:

Endura Manufacturing Company	Endura
Fibre Finishing Company	Vellumoid
Garlock Packing Company	Garlock No. 680
H. W. Johns-Manville Company	Seigelite

Boiler Gaskets

Boiler gaskets for manholes and handholes or for the tube caps, tube plates and headers of watertube boilers are ordered of the desired thickness made up from templates and are only made from sheet packing or gasket tape in case of emergency. The material is usually the best long fiber woven asbestos cloth, with bronze or brass wire insertion, the layers of cloth being firmly held together by a high grade cement or binder. They should not be loaded with a lot of white lead or other filler. Some special combinations of metal and asbestos have been found satisfactory.

An emergency gasket may be cut from woven asbestos cloth brass wire insertion sheet, but it will not last long and should not be used where exposed to water.

Old boilers cannot use rigid type gaskets and may require thicker gaskets than new boilers.

Gaskets for handholes should be made without joints. Manhole gaskets may have joints covered with tape.

The following list names some of the gaskets which have been found to give good service:

	Handhole	*Manhole*
Asbestos Textile Company		Navy
Belmont Packing & Rubber Company	Belmont High-Pressure	Belmont High-Pressure
Philip Carey Company		No. 751
Crandall Packing Company	Helios	Helios
Danubil Company	Hudsonil	
Durabla Manufacturing Company	Durabla	
Flexitallic Gasket Company		Flexitallic
Johns-Manville Company	Kearsarge (seamless)	Kearsarge (best)
Keasbey & Mattison Company	Battleship	Battleship
Vulcan Asbestos Mfg. Company	Vulcan	Vulcan

Miscellaneous Packings

Canvas

No. 6 canvas painted with red lead on the condenser side and with graphite on the cover side makes a good jointing for main and auxiliary condenser head covers.

Corset Lacing

This is the approved packing for making tight joints around the ends of condenser tubes.

Tar Felt

This is used between sea chest flanges and the shell plating, and similar service. The material is described in the article on "Calking Materials."

Cup Leather

Cup leather packings are sometimes required for the reversing engine and other special service, and are obtainable from the packing manufacturers.

Paste Jointings

Red lead, white lead and other substances in paste form are sometimes used to make tight joints, either alone or when mixed into fibrous materials.

One of the best of these paste jointings is an imported proprietary substance called manganesite. It has been found very satisfactory for turbine casing joints. This material with wire gauze is used between the flanges of boiler mountings and the boiler shell.

The following is a good list of engineer's consumable stores of packing for one ship:

Steam Packing—Quantity

High pressure steam packing, square, spiral, for Main engine piston and valve rods, sizes as needed	2 sets of each
High pressure steam packing, square, spiral, for Piston rods for pumps and deck machinery, ⅜, ½, ⅝, ¾ inch and above, if required	1 box of each
Valve stem packing, asbestos, braided, ⅛, ¼, ⅜, ½ inch	1 box of each
Asbestos tape, 1½ by ⅛ inch	10 pounds
Asbestos tape, 1 by ⅛ inch	10 pounds

Water Packing

Flax or Tuck's, square, for pump rods and plungers, ⅜, ½, ⅝, ¾ inch and above, if needed	1 box of each
Stern tube gland, size as needed	1 box
Cotton lamp wicking, for cold water, in 100 yard balls	5 balls
Corset lacing, for condenser tubes, in 100 yard balls	2 balls

Sheet Packing (Standard Size Sheets)—Quantity

Asbestos fiber compressed, high pressure steam joints, 1-16 inch thick, for—	
Reciprocating engines	10 square yards
Turbines	5 square yards
Compressed wood fiber, for oil joints, 1-32 inch thick	5 square yards
Rubber, wire insertion, for hot water or exhaust steam, 3-32 inch	5 square yards
Rubber, cloth insertion, cold water, 1-16 inch	10 square yards

Special Packing and Gaskets

Asbestos or cup leather, for reversing engine cylinder, as needed	2 sets
Ice machine compressor's rods, as needed	2 sets
Rope, asbestos, twisted, for boxheaders, watertube boilers, ⅜ inch, if needed	1 ball
Gaskets, manhole, boilers, as needed	1 dozen
Gaskets, handhole, for watertube boilers, as needed	100 percent
Manganesite, for turbine joints	10 pounds

Tests of New Pumping Equipment on New York City Fire Boat "James Duane"

TESTS lasting six hours were recently run on the new pumping equipment of the New York city fire boat *James Duane* at the Clinton plant of the Todd Shipyards Corporation.

The tests were under the supervision of the fire commissioner Thomas Drennan and other officials from the fire department and the National Board of Underwriters. The results indicate that the boat will be one of the most efficient fire fighters afloat, having a discharge capacity of 9,800 gallons per minute against a nozzle pressure of 150 pounds.

The new pumps are of the Lea-Courtney centrifugal, single stage, double suction type driven by Westinghouse steam turbines. The tests included the pumping capacity against 175 pounds' nozzle pressure, at which pressure the pumps delivered 7,900 gallons per minute; against a pressure of 300 pounds the capacity was 4,850 gallons per minute. The guarantee called for 9,000 gallons of water against a nozzle pressure of 150 pounds; 7,500 gallons against a pressure of 175 pounds and 3,000 gallons of water against a nozzle pressure of 300 pounds; all of which requirements were exceeded in the trials. In case of necessity in flooding the hold of a ship, the pumps will be able to deliver about 12,000 gallons of water per minute against a nozzle pressure of 90 pounds.

Special Requirements in Design of Marine Machinery

Reliability—Weight and Space—Accessibility—Resistance to Corrosion—Stresses Induced by Movement of Vessel and Vibration—Spare Parts

By Lieutenant Commander C. S. Gillette, U. S. N.*

IT is a matter of common observation that many designs of mechanical and electrical equipment, based on ideas fundamentally sound, and proven by practical experience in shore establishments, fail deplorably when an attempt is made to adapt them to marine installations. It appears certain that a large percentage of such failures could be avoided, if due consideration were given to the special requirements of marine and naval service and an effort made to modify the design to meet such requirements before the marine market is approached.

Of course great merit in any new design will eventually win out and after a sometimes long and painful process of evolution the equipment will finally arrive at a stage of complete suitability for marine or naval use. But the process of evolution could be much shortened and time and money saved by both user and producer, if even a partial realization of the conditions to be met were possible before the original trial on board a vessel.

Why Marine Practice is Conservative

Marine practice is always conservative and it has good reason to be. Naval practice is perhaps somewhat less so because of the need of being strictly up to date in all that pertains to fighting efficiency so that experimentation is more readily accepted. Fighting efficiency is and must always be the primary consideration of the Navy and first cost and operating expense the secondary, except where the latter may directly or indirectly affect the former.

Conservatism in marine practice is more than mere caution induced by past experience with careless designs. No matter how excellent the design of mechanical or electrical equipment may be it is absolutely dependent on the ability of the personnel available for operation and upkeep. The training of personnel on new equipment is an expensive process, and nowhere more so than in the marine and naval service, where efficient personnel is the product of long experience and the number available very limited. Strong prejudice always exists to a more or less extent among such personnel, against innovations, and unless a design has been well thought out originally and the special marine requirements given weight it will be in danger of quick condemnation on the first minor indication of deficiency even though basically the idea may be sound. Particularly is this true of the many small items of auxiliary equipment and apparatus designed to give increased economy, convenience, safety or add in some other way to operating efficiency.

The Case of the Scotch Boiler

As an example of this conservatism the old cylindrical Scotch type boiler still remains the standard in the commercial marine service despite the many attempts to displace it. It has of course certain fundamental characteristics which make it especially valuable for this service such as the large amount of water contained, the volume of the steam space and the relatively smaller amount of attention required in operation and upkeep. But its long record of satisfactory operation and the complete familiarity of the personnel with all the details of the design have much to do with its permanence as a standard in this field. It holds its own in spite of the passing of its companion the reciprocating engine although even the latter has held on longer than was justified by its many un-economical features. This latter was reliable and the personnel were familiar with it which fact, added to the reliability of the design, has made it a favorite until the keenness of competition in ocean freight rates gradually is forcing it out.

It is at once obvious that marine and naval requirements cannot be exactly specified in an absolute sense. However, it seems that it would be of some value to point out certain of the most outstanding features of this service as it differs from conditions on shore.

Manufacturers Too Often Unfamiliar With Seagoing Conditions

The seagoing man often takes for granted a knowledge of conditions existing at sea among landsmen which to the former scarcely seem worth mentioning because they are so obvious. Among manufacturers in general, however, who have not had an opportunity to see for themselves at first hand just what these conditions are it is not believed that they are quite so obvious. Certainly, if their products may be considered as evidence of such knowledge, it is apparent that it is often decidedly lacking or dependence is placed on the failure of marine and naval purchasing agents to discover the defects. The failure of purchasing agents to reject, however, does not prevent a mechanism from failing in service and this soon reacts seriously on the manufacturer and may mean his being more or less completely cut off from the marine or naval market. Among sea going engineers news of failures of material travels swiftly and aided sometimes by competitors' agents it reaches the ears of those far removed from the scene of the original failure and the manufacturer may find himself shut off from supplying materials of entirely different nature than those on which failure occurred and which might be entirely suitable.

It will be understood of course that all the desirable characteristics as to economy, etc., included in a design for land installations are equally important at sea. In addition thereto certain of these must be of a higher standard for sea service and a few included which land service does not require. However, it has been the experience of at least a few manufacturers that, in developing their product to meet marine demands, the same development was quite advantageous and equally applicable in improving their products for land service.

Special Requirements of Commercial Marine Service

The special requirements of commercial marine service are about as follows:

a—Maximum reliability.

b—Minimum space and weight factors.

c—Maximum accessibility for inspection, cleanliness and repair.

d—Maximum resistance to corrosion.

e—Satisfactory operation on a moving platform and in planes inclined to the horizontal from 15 to 20 degrees with special attention to lubrication under these conditions which occur on a ship in service.

f—Ability to withstand large and uneven stresses induced by the laboring of a vessel in a heavy sea way and the variable propeller load.

*Laboratory officer, New York Navy Yard, Brooklyn, N. Y.

g—Satisfactory operation under vibrations of the mounting at fairly high frequencies.

h—Adequate spare parts but no more than is actually necessary, exactly fitted to their place and arranged for easy installation and stowage.

j—Suitable marking of all equipment and parts for ease of identification and accurate requisitioning from distant parts of the world.

The special requirements for the naval service include all of the above with a somewhat higher standard of performance especially in regard to the first four. In addition it demands the following characteristic:

a—Satisfactory and continuous performance under heavy shock, as that induced by the discharge of the vessel's own guns of fairly well known and constant amount, or by the striking of enemy's shells and explosion of mines or torpedoes at almost any point of the ship's structure and of more or less unknown amount. The design must always take into account the maximum possible effect.

Another point of difference between the marine and naval services is that the latter usually is supplied with sufficient personnel for inspection, upkeep and repair—a personnel better organized and under better control. Thus material on naval vessels receives more attention and care and can be kept in better condition than that of the merchant marine. However, on a naval vessel there is a much greater quantity of apparatus and equipment of a more delicate nature so that in spite of the additional personnel available the design must take into account and consider all of the factors set forth.

Reliability

Taking up individually the above enumerated requirements for discussion it appears that reliability is the most important and essential of all. Many of the others that follow in the enumeration more or less directly affect this fundamental characteristic. Reliability of course is important in land practice but to a relatively much less degree. Failure in a land plant rarely causes more than inconvenience and some financial loss. Nearly always spare machines are available or an auxiliary power source can be utilized with little difficulty. Further, unlimited technical assistance and repair facilities are quite usually at hand or can be quickly obtained. First cost only limits the number of spares that can be kept on hand and often nothing of consequence is strictly essential because of the proximity to the source of supply.

In contrast to this consider the position of a vessel at sea when break down occurs. If it takes place in stress of weather, as is often the case, the conditions are infinitely worse. Anyone who has ever attempted important repairs on a ship which is rolling and pitching violently in a heavy seaway will not be very approachable on the subject of the purchase for a vessel of an apparatus whose reliability is not absolutely proven. At such a time too the name of a manufacturer who has thoughtfully anticipated such conditions and planned for ready lifting and handling and easy installation of spares will be blessed. Particularly is this true when spares fit properly without the slightest alteration.

Repairs at Sea

The number of spares that can be carried is very limited. A vessel is built to carry cargo—not a multitude of spares—and in the case of a naval vessel to make high speed for fighting and all unnecessary weight must be cut down. To make the necessary repairs a vessel can draw only upon her own resources and the ship's engineers must furnish all the technical assistance that is needed. The lives of the crew and passengers and the value of the ship and cargo may be and often are dependent upon their unaided skill. The facilities available are never more than a meager supply of machine and hand tools, the knowledge of the ship's engineers and the skill of their own hands.

As a rule there is always sufficient floor space available in land installations or it can easily be obtained, while weight is seldom if ever an installation factor, other than a problem of handling. On ship board, however, there is never entirely adequate space. In order not to defeat the object for which the ship is built it becomes one of the greatest problems of marine construction to arrange her necessary equipment in the smallest possible space, consistent with safe operation. The same is true of weight. The capacity and floatability of a vessel are the factors which justify her existence as a ship and anything that detracts from either the one or the other reduces in the same proportion her value for the purpose for which she was constructed.

Accessibility

Considering the necessarily restricted space it is at once obvious why special attention must be given to accessibility. When cleaning and repairs must be executed in an extremely confined space, a design with conveniently accessible units will necessarily be considered the most successful. The troubles of the operating engineer at sea are sufficiently great under the handicap of confined working space without adding to them by the installation of a poorly thought out assembly which would be difficult to take care of even under normal conditions of illumination, floor space and handling facilities. The personnel on board ship usually does its work in cramped locations, with poor lighting and high temperature conditions and on an often violently moving platform. Careful thought must be given to any heavy weights that must be handled and facilities provided for taking care of them under rolling and pitching conditions on a vessel. To lose control of a heavy weight under the latter condition endangers life and limb and even possibly the ship itself. Easy inspection is also essential in order to promote reliability. Any apparatus, the careful inspection of which is difficult, will naturally receive less attention and break downs of serious nature, which might be prevented by timely steps to repair worn parts, will occur.

Corrosion

Sea air is highly corrosive and parts not properly protected or of easily corrodible material will disintegrate with the greatest rapidity, far exceeding that of any ordinary land practice. Even in fittings designed to be strictly watertight, the structure "breathes" during changes of temperature and air saturated with moisture will enter and corrodible materails will be quickly attacked. Increase of temperature forces air out and a drop will draw air in. A further drop will precipitate moisture from the saturated sea air and corrosion commences. Below decks there is leakage from pipes and condensation of vapor of steam and oil added to sea air from the ventilating blowers and usually high temperature—in general, about the best conditions to promote active corrosion possible to obtain. To this may be added the ever present danger of galvanic action between the many dissimilar metals of a ship's structure and water with varying degrees of acidity or alkalinity. It is not possible for a design to go too far in an effort to resist corrosion. It is the ever present foe of steel ships and their fittings and the landsman designing for marine installations must appreciate the danger to the full or his design must inevitably fail.

Marine machinery operates on a moving platform. Any apparatus that employs the force of gravity to function properly will be at a serious disadvantage in the marine field even if it would work at all, as this force will be received through constantly changing angles. One of the most common difficulties experienced is interference with the lubrication through the changing of the amount of the bearing pressures and the introduction of stresses and strains through the working of the flexible ship's structure which forces change of alinement of bearings and varies the bearing clearances.

FLEXIBILITY OF SHIP'S STRUCTURE AND VIBRATION

Further, due to this flexibility of the ship's structure, stresses are uneven and the design must have a rigidity and strength to withstand them, entirely uncalled for in land practice. The laboring of a ship in a sea way, the variable propeller load and differences in the loading all contribute toward making even the lightest duty relatively difficult under such varying conditions. The tunnel bearings of the propeller line shafting of a vessel give a good illustration of this as the temperature of these bearings is constantly changing as the loading or the weather conditions change. A bearing running cold today will be hot and require constant attention the following day if the loading is changed or the weather conditions vary.

Vibrations are more or less a source of difficulty. However, in this respect conditions on land are often nearly as bad. In every part of the ship's structure, however, they are present. With modern vessels they are less a problem. They affect instruments mainly and the more delicate of the ship's equipment and in such classes of apparatus they must always be considered.

SPARE PARTS

The question of spare parts has been discussed under the requirement of reliability. The number must be limited not only because of cost but because of lack of stowage space. Those that are furnished must be accurately fitted, arranged for stowage, handling and ease of installation. A modern naval vessel particularly is a veritable maze of intricate machinery for each item of which more or less spare parts must be carried. Convenient stowage is difficult and parts must be properly protected and arranged for easy identification, particularly for naval vessels. Interchangeability is a great advantage not only for parts carried but for parts that may be ordered in distant parts of the world. Proper arrangements for identification of parts in ordering must be arranged for in order to avoid confusion and delay when the need may be urgent and the factory distant.

The Navy, as previously stated, adds to the above the requirement that the apparatus shall be proof against shock. It is readily appreciated that, in a naval engagement, shock of discharge of a vessel's own guns and the impact of the enemy's shells, torpedoes and mines on the vessel's structure may seriously derange vital mechanisms even though no direct hit on the mechanism itself were made. The effect of discharge of a vessel's own guns is a measurable quantity, but the effect of the striking of enemy' shells, etc., is a very uncertain affair. However, these things must be always taken into account in a design and allowed for in the mounting and in the relations of the various parts to each other. Such equipment as circuit breakers, for example, form a good illustration of equipment easily deranged by shock. It would appear at first thought that this demand could not always be satisfactorily met but it must be met, if a naval vessel is to fulfill its mission as an efficient fighting unit, and experience has shown that by careful consideration much can be accomplished as in the case of the illustration given above, viz. naval circuit breakers.

Much more could be said along these same lines but it is hoped that enough has been given to bring out some of the most important of the difficulties to be overcome in successful marine design as opposed to land practice.

Chamber of Shipping Gives Rules to Prevent Pilferage

Claims Twenty Times as Large as Before War Have Been Paid for Pilferage by Shipowners Since Armistice

THE Council of the British Chamber of Shipping appointed a committee in 1920 to study the subject of pilferage and to prepare a set of recommendations for the prevention of theft which has increased to an alarming extent since the war. This committee has formulated rules which it is hoped will be found applicable to the ports of all nations, and particularly to those ports where shipowners are suffering from excessive claims on cargo.

Three reasons are given for the increase of the pilferage evil, namely: (1) The general increase in values which augmented the pre-war claims about threefold. (2) Chaotic conditions occasioned by the war, especially interference in and control of trading facilities by Government departments and the congestion resulting from a trade boom immediately succeeding the war. (3) By far the most important factor, however, was the increase in the general debasement of the standard of common honesty which was a legacy of the war.

While the following rules are necessarily general in character in order that they may cover all ports and while some ports have organizations which are effective in the prevention of pilferage, it is recommended that the rules be accepted by shipowners, particularly where pilferage is common.

1. TALLIES AND WATCHING

"Tallies should be taken both in and out of ship. It is specially important that this should be done when discharging on to open quays, or into lighters, or on to the quays of docks and warehouses not under control of the shipowner.

"The absence of tallies should be permissible only when the quay is absolutely under the sole control of the shipowner; but even where shipping companies use their own wharves the Committee consider it is desirable that these tallies should be taken in order to locate the individual responsibility of each man handling the goods. Without such precaution it is impossible to investigate satisfactorily each stage in the process of discharge and loading and thus fix the exact spot where the error, loss or damage arose.

"Generally, the Committee desire to emphasize that it is impossible for officers to perform their duties adequately unless a legible and clear tally of the cargo is received at the port of shipment More care is required on the part of all tally clerks to ensure that their tallies, including carbon copies, are complete and distinct. If these particulars are not accurate and distinct, it leads to much confusion on discharge and in such cases the officers who supervise the disharging are seriously hampered in their duties.

2. OFFICERS

"An officer or his representative should be appointed to each hold.

"Where sufficient officers are not available to supervise at each hold, substitutes should be appointed from among the petty officers, apprentices, wireless operators and other reliable members of the crew.

"Wireless operators and watchers should be regularly employed in addition to officers in connection with the work of supervising the tallying and watching of cargo, and it is desirable that steps should now be taken to constitute them part of the ship's personnel for performing cargo duties in port, under the orders of the master. This is a reform which will yield the wireless operators some much-needed occupation in port, and the deck officers some relief at busy times.

3. ALPHABETICAL TALLY BOOKS

"The Committee recommend the extended use of the aphabetical system (with which most shipowning organizations are familiar) by those tallying on behalf of ship, which prevents collusion with those using continuous sheets tallying against the ship. If the tally into the ship is not taken alphabetically, the continuous sheets should show the number of the hatch into which cargo is being worked. The officers during the voyage should prepare from these

loading sheets a separate alphabetical tally book for the cargo for each port of destination in each hatch and, in addition, a second set of such alphabetical books may be prepared for use by ship's tally clerks in discharging. This will be found most advantageous. This second set should show the marks only, and the numbers should be added by the ship's tally clerk in discharging. On ceasing work each day these tally clerks should hand their books or tally sheets to the officers to check them off with their own complete tally books and thereby be able to follow closely the accurate outturn and take prompt steps to trace any deficiencies and to have 'bad order' goods assessed for damage by ship's surveyor before leaving port. The books with marks prepared save many errors through speed of discharge leading to inaccurate record of marks.

4. Precautionary Measures on Board Ship

"(a) There should be only one entrance to cargo holds, viz., down the hatchway.

"(b) All ventilators should be protected in order to prevent access to holds through them.

"(c) All hatches should be fitted with bars and locks capable of being quickly and easily manipulated and kept closed and locked during the passage between coastal ports.

"(d) In insulated steamers when holds are loaded with general cargo the doors leading from the engine room, &c., to the air trunks and holds should be locked and the key kept always by a responsible cargo officer.

"(e) During meal hours, the deck should never be left without an officer in charge, and when contractors are working in the holds during the stevedores' meal hours a special watchman should be stationed in the hold to watch these men.

5. Pilferage at Sea

"If, during the course of a voyage, tampering with the cargo or pilferage thereof has been discovered by the officers, the Commitee recommend the master of the ship to communicate with the agents by wireless requesting them to send detectives on board the ship before the vessel is moored alongside the quay; so that a proper search may be instituted and the thieves discovered and prosecuted.

6. Dock and Harbor Aurhorities and Ships' Passes

"Where goods are tallied by the ship within sight of the ship's rail, dock and harbor authorities receiving the cargo should always give receipts for same.

"The authorities should be more strict in the scrutiny of persons allowed to enter and leave dock and harbor premises.

"A system of triplicate passes should be adopted in all ports for any goods taken out of docks under the ship's pass (called 'Goods Passes'), one to be retained in the pass book of ship, and two to be handed to the person in charge of the goods, both of which should be given up at the dock gates. The dock authority should retain one of these two for their purposes and send the other to the ship's agent. Where this procedure has been adopted it has been of great benefit.

"There should be stricter examination of conveyances by road and water (carts, lighters, &c.) by those who are charged with this duty.

"The Committee recommend that port authorities should accept full responsibility for all cargo not removed from transit sheds within seventy-two hours from final landing of the goods. The Committee consider similar conditions should even apply at ports of the world where the legal limit of seventy-two hours is not imposed, particularly where, as is frequently the case, the port authority is the constituted agent of the consignee for taking delivery. This practice should be recognized in cases where steamship owners rent a quay with sheds for the discharge of their steamers' cargoes. It is obvious where sheds are rented merely as transit sheds the receiving authority should be responsible for the safe-keeping of the goods in such sheds, after the usual seventy-two hours.

7. Damaged Packages

"When, during the discharge, packages are discovered which have been tampered with, or damaged in any way, the Committee recommend the following system should be adopted:

"(1) Such packages should be retained on board the ship under the officers' supervision until they can be discharged and their condition certified, or

"(2) Immediately on landing placed in a special cage, lock-up or other safe depository.

"(3) As a precautionary measure such packages should immediately be weighed and the ascertained weight indelibly marked on the package; they should also be securely fastened.

"(4) Goods of this description should be thoroughly examined and the condition of them agreed with the officers before the ship leaves the port.

"Customs authorities should be urged to support officers and agents in this procedure.

8. Pilferage Reports to Owners

"Shipowners should bring claims at all ports under the scrutiny of a well-equipped department at head office. The results are calculated well to repay the expenditure. Reports should be sent direct to such claims department promptly at the time when the pilferage is discovered, and should show specifically which claims arise from pilferage. These reports should contain precise particulars to enable the department to trace the goods in question.

9. Legal and Magisterial Action

"Shipowners should prosecute every detected case of pilferage. There is a certain reluctance to institute legal proceedings, but such proceedings are imperative if pilferage is to be stopped.

"Magistrates should be urged to impose imprisonment on persons convicted of pilfering. Fines are generally inadequate and moreover are usually paid by the delinquents' mates or associates.

"The magistrates' powers of dealing with persons convicted of unlawful possession should be enlarged and the maximum fine in this country should be increased from £5 to £20.

10. Bills of Lading, Mate's Receipts and Indemnities

"The Committee strongly deprecate the custom of issuing Bills of Lading for goods 'Received for Shipment' except where the circumstances make no other form appropriate; such a system gives scope for pilferage. In no case should shipowners, however great the pressure from merchants, issue a 'Shipped' Bill of Lading until the goods are actually on board the steamer, as the difficulties of protecting the steamer against claims for pilferage which may have happened before shipment are thereby greatly increased.

"Mate's receipts should not be claused indiscriminately with words used as 'more or less frail.' The actual condition of the goods should at all times be accurately noted in detail on the receipt and also on the Bill of Lading. Many shippers desire shipowners to accept indemnities in lieu of clausing Bills of Lading in accordance with the facts; this practice should be discouraged to the utmost. Courts of Law condemn the practice of giving such indemnities, by which bankers and other holders of Bills of Lading are undoubtedly misled.

11. Insufficient or Frail Packages

"Shipowners should reserve their right to reject goods appearing to be insufficiently packed and also their right to plead insufficiency of packing, at whatever part of the voyage it comes to light.

12. Special Goods, Specially Addressed Packages and Returned Packages

"These goods should always be carried in lock-ups securely fastened with two locks. The master should retain the key of one lock and the principal cargo officer the other. The cage or chamber should never be opened unless an officer is present.

13. Customs Examination

"Customs officials should mark with an official stamp or seal all cases and casks from which samples have been extracted.

14. Instructions to Masters and Officers

"The Committee suggest that shipowners should revise their standing instructions to masters and officers in reference to the care and handling of cargo with the object of bringing them up to date and giving this aspect of their officers' duty its due prominence.

"It has been said that the Committee's proposals are not likely to secure the active co-operation of the ship's officers. In reply to this evidence is forthcoming to show that officers are realizing their duties and are giving the most loyal assistance wherever the proposals are being adopted. In some cases further improvements in practice are suggested by the officers, which shows not only that the right lines are being recommended, but that the interest of officers has been aroused. The Committee suggest that Liner Cargo Superintendents should be requested to encourage the officers to take an interest in cargo as being the connecting link between the cargo departments at the respective ports.

15. Department of Overseas Trade

"Finally, the Committee desire to bring to the notice of shipowners this Department which is responsible to the Foreign Office and the Board of Trade for commercial matters in the hands of British Government representatives abroad. Each British Ambassador and Minister has on his staff a Commercial Secretary who is responsible for co-ordinating the work of the Consuls. Some of the Commercial Secretaries during their leave in this country have visited the Chamber of Shipping, and the Committee had the privilege of meeting them. They appear to have been excellently chosen for their combined knowledge of British commercial matters and the conditions of the country to which they are accredited. In the Committee's view, shipowners would be well advised to keep in touch with these gentlemen.

British Regulations Against the Discharge of Oil Into Navigable Waters*

OIL in Navigable Waters Act, 1922. Chapter 39. An Act to make provision against the discharge or escape of oil into navigable waters. (4th August 1922).

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

Penalty for Discharge of Oil in Navigable Waters

1.—(1) If any oil is discharged, or allowed to escape whether directly or indirectly, into any waters to which this Act applies from any vessel or from any place on land or from any apparatus used for the purpose of transferring oil from or to any vessel to or from any other vessel (whether a vessel to which this Act applies or not) or to or from any place, the owner or master of the vessel, from which the oil is discharged or allowed to escape, the occupier of the land, or the person having charge of the apparatus, as the case may be, shall be guilty of an offence and shall, in respect of each such offence, be liable on summary conviction to a fine not exceeding one hundred pounds:

Provided that it shall be a good defence to proceedings for an offence under this section to prove—

(a) if the proceedings are against the owner or master of a vessel, that the escape of the oil was due to, or that it was necessary to discharge the oil by reason of, the vessel being in collision or the happening to the vessel of some damage or accident, and also, if the proceedings are in respect of an escape of oil, that all reasonable means were taken by the master to prevent the escape; and

(b) if the proceedings are against any other person and are in respect of an escape of oil, that all reasonable means were taken by that person to prevent the escape.

(2) It shall be lawful for a harbour authority to appoint a place within their jurisdiction at which the ballast water of vessels in which a cargo of petroleum spirit has been carried may be discharged, and where a place is so appointed any such ballast water may, notwithstanding anything in this section, be discharged at that place, but only at such times and subject to such conditions as the harbour authority may from time to time determine:

Provided that the foregoing provision shall not apply to ballast water containing oil other than petroleum spirit.

For the purposes of this subsection, the expression "petroleum spirit" means refined petroleum which is subject to rapid evaporation and which, when tested in the manner prescribed by the Petroleum Act, 1879, or any enactment amending that Act, gives off an inflammable vapour at a temperature of less than 73 degrees of Fahrenheit's thermometer.

Prohibition of Transfer of Oil at Night

2.—(1) It shall not be lawful during the hours between sunset and sunrise to transfer any oil to or from any vessel lying in any harbour unless notice of intention so to do has been given in accordance with the provisions of this section.

(2) If any oil is transferred to or from any vessel in contravention of the provisions of this section, the master of the vessel and, if the oil is transferred from or to premises on land, the occupier of the premises shall, in respect of each offence, be liable on summary conviction to a fine not exceeding twenty pounds.

(3) A notice for the purpose of this section must be given to the harbour master of the harbour in which the vessel is lying and shall be of no effect unless given at least three hours and not more than ninety-six hours before the time at which the operation of transferring the oil commences:

Provided that, in the case of an operation to be performed at a place where such operations are frequently and regularly carried on, or in the case of a transfer of oil for fire brigade purposes, the notice may, instead of being a notice given to the harbour master within the time hereinbefore provided, be a general notice given to the harbour master to the effect that such operations will during such a period not exceeding twelve months from the date of notice, as may be specified therein, be carried on between sunset and sunrise.

Keeping of Records with Respect to Transfer of Oil

3.—(1) There shall be kept in the case of every vessel a record, in such form as the Board of Trade may prescribe, of all operations in connection with the transfer of oil to and from the vessel.

(2) The record required to be kept under this section shall, in the case of a barge, be kept, so far as relates to the transfer of oil to the barge, by the person supplying the oil, and, so far as relates to the transfer of oil from the barge by the person to whom the oil is delivered, and shall, in every other case, be kept by the master of the vessel.

(3) Every record kept under this section may at all reasonable times be inspected by the harbour master of the harbour in which the vessel is or, in the case of a barge, was at the time of transfer or by any person duly authorised in that behalf by the Board of Trade, the Minister of Agriculture and Fisheries, the Fishery Board for Scotland, or the Ministry of Commerce for Northern Ireland.

(4) If any person required to keep a record under this section fails to keep such a record or to make proper entries therein, or to produce the record on a demand in that behalf made by any person authorised to inspect it, he shall, in respect of each offence, be liable on summary conviction to a fine not exceeding fifty pounds, and if any such person makes any entry in the record which is to his knowledge false or in any material particular misleading, or wilfully fails to make any entry in the record, he shall, in respect of each offence, be liable on summary conviction to a fine not exceeding one hundred pounds.

Liquid Contained in Spaces Used for Carriage

4.—(1) Where oil has been contained in any tanks or other spaces in a vessel, any liquid discharged or allowed to escape from those tanks or spaces shall, unless it is proved that the tanks or spaces have been cleaned of oil, or that the liquid has been freed from oil by means of a separating apparatus, be deemed to be oil within the meaning of this Act.

(2) In the case of proceedings against any person other than the master of a vessel, evidence of the matters aforesaid may be given by means of a certificate signed by the master, and, if the master of a vessel gives any certificate under this section which is to his knowledge false or in any material particular misleading, he shall, on summary conviction, be liable in respect of each offence to a fine not exceeding fifty pounds.

(3) In this section the expression "master of a vessel" means the person named as the master in the agreement with the crew.

*From the Transportation Division, Department of Commerce, Washington, D. C.

Application of Fines

5.—Where any person is convicted of the offence of having in contravention of the provisions of this Act discharged or allowed to escape any oil into any waters to which this Act applies, the court before which he is convicted may, on application of the prosecutor, order that the whole or any part of the fine imposed in respect of the offence shall be paid to such person as the court may direct for the purpose of being applied by him in or towards meeting any expenses incurred or to be incurred in the removal of the oil so discharged or allowed to escape.

Power to Inspect Premises and Vessels

6.—(1) The Board of Trade may, if they think fit, either at their own instance or at the instance of the Minister of Agriculture and Fisheries, the Fishery Board for Scotland, or the Ministry of Commerce for Northern Ireland, or of any local authority, appoint any officer of the Board of Trade or any other competent and independent person to inspect any vessel being in any waters to which this Act applies, and any person so appointed or the harbour master of the harbour in which the vessel is may at all reasonable times enter upon the vessel and examine the measures adopted to prevent the escape of oil.

(2) If it is represented to the Board of Trade, by the Minister of Agriculture and Fisheries, the Fishery Board of Scotland, or the Ministry of Commerce for Northern Ireland, or by any local or harbour authority, that there is reason to suspect that oil is escaping or has escaped, whether directly or indirectly, into waters to which this Act applies from premises adjacent to or in the neighbourhood of those waters, the Board of Trade may, if they think fit, appoint any officer of the Board or other competent and independent person to inspect the premises, and any officer or person so appointed may at all reasonable times enter upon and inspect the premises.

(3) If any person obstructs or interferes with any person authorised to enter on any premises or vessels under this section, he shall, on summary conviction, be liable in respect of each offence to a fine not exceeding ten pounds.

Legal Proceedings

7.—(1) Where an offence under this Act is alleged to have been committed by the master of a vessel who thereafter departs from Great Britain and Northern Ireland before the expiration of the period within which proceedings for the offence might have been instituted against him, proceedings for the offence may, notwithstanding any thing in the Summary Jurisdiction Acts, be instituted against him at any time within two months next after the date on which he first returns to Great Britain or Northern Ireland.

(2) For the purpose of any proceedings for an offence under this Act, the offence may be treated as having been committed either at the place at which it was actually committed or at any place in which the person charged with the offence may at any time be.

(3) Where a fine imposed by any court in proceedings against the owner or master of a vessel for an offence under this Act is not paid at the time and in manner ordered by the court, the court shall, without prejudice to any other powers of the court for enforcing payment, have power to direct the amount remaining unpaid to be levied by distress or poinding and sale of the vessel, her tackle, furniture and apparel.

(4) Proceedings for an offence under this Act shall not be instituted in the case of an offence committed in or in relation to the waters of a harbour except by the harbour authority, and in any other case except by a person authorised in that behalf by special or general directions of the Board of Trade, the Minister of Agriculture and Fisheries, or the Ministry of Commerce for Northern Ireland: Provided that nothing in this subsection shall apply to the institution of proceedings in Scotland.

Interpretation and Application

8.—(1) In this Act, unless the context otherwise requires—

The expression "oil" means oil of any description, and includes spirit produced from oil and oil mixed with water:

The expression "harbour" means any harbour whether natural or artificial, and includes any port, dock, estuary or arm of the sea, any river or canal navigable by sea-going vessels, and any waters in which sea-going vessels can obtain shelter or ship or unship goods or passengers:

The expression "harbour authority" includes all persons or bodies of persons, corporate or unincorporate, being proprietors of or entrusted with the duty or invested with the power of constructing, improving, managing, regulating or maintaining a harbour:

The expression "harbour master" includes any person appointed by a harbour authority for the purpose of enforcing the provisions of this Act:

The expression "master" when used in relation to any vessel means the person having the command or charge of the vessel for the time being:

The expression "vessel" has the same meaning as in the Merchant Shipping Act, 1894:

The expression "barge" includes lighter or like vessel:

The expression "transfer" in relation to oil means transfer in bulk:

The expression "local authority" means, in the application of this Act to England, the council of a county or county borough or urban or rural district or a port sanitary authority, in the application of this Act to Scotland the council of a county or burgh or a port local authority, and, in the application of this Act to Northern Ireland, the council of a county, county borough or county district, or a port sanitary authority.

(2) This Act shall apply to any vessel which is capable of carrying in bulk, whether for cargo or for bunker purposes, more than twenty-five tons of oil, or which, though not so capable is constructed or fitted to carry in bulk as aforesaid more than five tons of oil in any one space or container.

(3) The waters to which this Act applies are the territorial waters of Great Britain and Northern Ireland and the waters of harbours therein.

(4) For the purposes of section six of the Government of Ireland Act, 1920, this Act in its application to Northern Ireland shall be deemed to be an Act passed before the appointed day.

Short Title and Saving

9.—(1) This Act may be cited as the Oil in Navigable Waters Act, 1922.

(2) The provisions of this Act shall be in addition to and not in derogation of or substitution for any provisions for the protection of a harbour as defined in this Act contained in any existing Act or re-enactment thereof or in any order, rule, regulation, or bye-law made or to be made under such Act or any re-enactment thereof.

(3) This Act shall come into operation on the first day of January, nineteen hundred and twenty-three.

New York Electrically Driven Municipal Ferryboats

Propulsion by Squirrel Cage, Induction Motors Supplied With Current by Turbine-Driven Alternating Current Generators

By A. Kennedy, Jr.*

ELECTRIC ship propulsion which was fostered and largely developed through the effort of the General Electric Company has recently entered a new field of application, that is, the propelling of large double-ended ferryboats by means of turbine electric alternating current drive.

Few people, apparently, realized until recently the great advantage to be gained by propelling double-ended ferryboats electrically. For years it has been known that the ordinary bow propeller on double-ended ferryboats was extremely inefficient, but comparatively little has been done to improve the over-all efficiency of such boats.

Special propellers have been designed and built and they have, in certain cases, shown a material saving over the ordinary types of propellers used, but it was not until electric drive was applied to boats of this type that full advantage was taken of conditions known for years to exist in regard to propulsion of double-ended ferryboats.

Propelling Machinery

The three New York ferryboats being built by the Staten Island Shipbuilding Company will each be propelled by an 8-stage condensing Curtis marine type turbine, which has proven particularly well adapted for marine service. This fact is substantiated by the records of the Emergency Fleet Corporation, and also by the fact that approximately 90 percent of the turbine driven ships being built at the present time in England, which is the home of the Parson type turbine, are using the Curtis type of turbine.

Each ferryboat will be equipped with one General Electric turbine-driven alternating current generator, and this generator will in turn drive two marine type 2-speed induction motors having double squirrel cage rotors. In this connection, it is of interest to note that the induction motor rotors being used on the new New York City ferryboats are similar in design to those of the *New Mexico,* which was the first electrically driven battleship.

The relative speeds of the bow and stern propellers were determined by tank tests conducted for the City of New York, under the direction of M. G. Kindlund, naval architect.

The high speed winding will deliver 2,100 shaft horsepower at 176 revolutions per minute and the low speed will deliver 100 shaft horsepower at approximately 122 revolutions per minute.

The apparatus for controlling the motors and generator are of the dead front cell construction type. The general arrangement of the control panel is in brief as follows:

Control Panel

The bottom section includes a master control switch, watt-hour meter, generator rheostat handle, one electrical control lever, one turbine speed control switch and three manually operated levers. The electrical control lever controls the operation of the solenoid operated contactors. The turbine speed control switch controls the speed of the turbine from the control panel. The manual levers arranged from right to left are—the turbine throttle lever and two levers which are used in case of special emergency for operating the contactors.

The next section includes the various instruments and the top section the contactors.

After the turbine has been started and the hand operated throttle valve thrown wide open, the desired speed of approximately 25 percent of normal speed may be obtained by means of the turbine speed control switch which operates a long range governor. This governor may be operated, if desired, manually, by means of a hand wheel located on the turbine, or the speed controlled by the hand operated throttle valve lever located on the control panel.

Operation of the Electrical Lever

The operation of the electrical lever is as follows:

The first position in either direction will close the line contactors on the stern high speed motor winding. The second position will close the generator field contactors applying approximately double excitation. It should, therefore, be noted that the main line contactors for high speed propelling motor windings are closed on the dead circuits. The propelling motor having started and come in step with the generator, the electric lever will then be moved to the third position which reduces the excitation on the generator to normal. This is done by means of a transfer resistance so that generator field circuit is not opened during this transfer. The ship may then be brought up to the desired speed.

The fourth position of the electrical lever closes the bow slow speed motor contactors, this being the maximum efficiency running position. The slow speed motor winding is so designed that when this motor is operating on this winding it cannot take more than approximately 200 percent current and may, therefore, be easily thrown on the line with full voltage. The water acting on the bow propeller will tend to break the bow propeller loose and, therefore, this motor is not designed for the normal breaking away torque which would be required in case this motor was thrown on the line before the ship was under way.

To stop the ship, the electrical lever is thrown to the off position, there being a certain time interval between the opening of the generator field contactors and the opening of the main propelling motor contactors. This time interval is provided so that the generator field will die down and, therefore, there will be a minimum amount of arcing on the main propelling motor high speed winding contactors. At the same time that the electrical lever is thrown to the off position, the turbine speed will be reduced by means of the electric speed switch. The governor on the turbine is so designed that it will hold constant speed from 25 percent to 100 percent either with or without load.

Maneuvering

The ship may be maneuvered, as described above, either ahead or astern.

In maneuvering, all power is placed on the most efficient propeller for accomplishing the desired result; that is, in stopping the boat, all power will be placed on the bow high speed motor winding, the speed of the motor being controlled by the speed of the turbine.

To further increase the efficiency of these ferryboats, most of the engine room auxiliaries are motor driven, obtaining their power from a 125-kilowatt condensing turbine driven direct current generator.

*Marine Engineering Department, General Electric Company, Schenectady, N. Y.

Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Allowances for Scrap in Ship Construction

Q. (1172).—What do you consider reasonable allowances for scrap in the cases of some of the principal materials entering into ship construction?

A. (1172).—The following percentages may be taken as reasonable, although there is some variation due to differences in practice in different building yards:

	Scrap—Percent
Plates and shapes	15
Rivets	15
Steel and iron castings	10
Steel forgings	10
Iron forgings	15
Brass castings	10
Bronze	10
Zinc	10
Lead and copper	net
Rubber	10
Decking (white or yellow pine)	10
Tarred felt	net

Resistance Due to Foul Bottom

Q. (1173).—Can you give me any information as to the relation between time out of dock and resistance due to foul bottom?

A. (1173).—Only very general information can be given in answer to your question because the result in a given case depends upon the temperature and the degree of salinity of the water, the speed of the ship through the water when under way, and the proportion of the time out of dock which has been spent in actual steaming.

Admiral Taylor in "Speed and Power of Ships" states that in extreme cases of fouling a vessel's bottom may have a complete incrustation of shell fish and this may result in skin resistance four or five times that of the clean ship. He states further that, in practice, such fouling is permitted only under exceptional circumstances, vessels being docked at intervals. But even in cool waters when fouling usually goes on rather slowly a vessel three or four months out of dock is liable to have an increase of 20 percent or more in skin resistance, and in tropical waters the increase of resistance is greater.

In a certain case with which the writer is familiar a vessel divided her time about equally between cool and warm waters. She spent a short time in fresh but most of her time in salt water. She spent about twenty percent of the entire time in actual steaming at slow speeds. During her first six weeks out of dock her resistance increased about fifteen percent. Thereafter for about seven months the increase was gradual and quite uniform. At the end of the period of nine months out of dock the resistance had increased 30 to 40 percent over that on leaving dock.

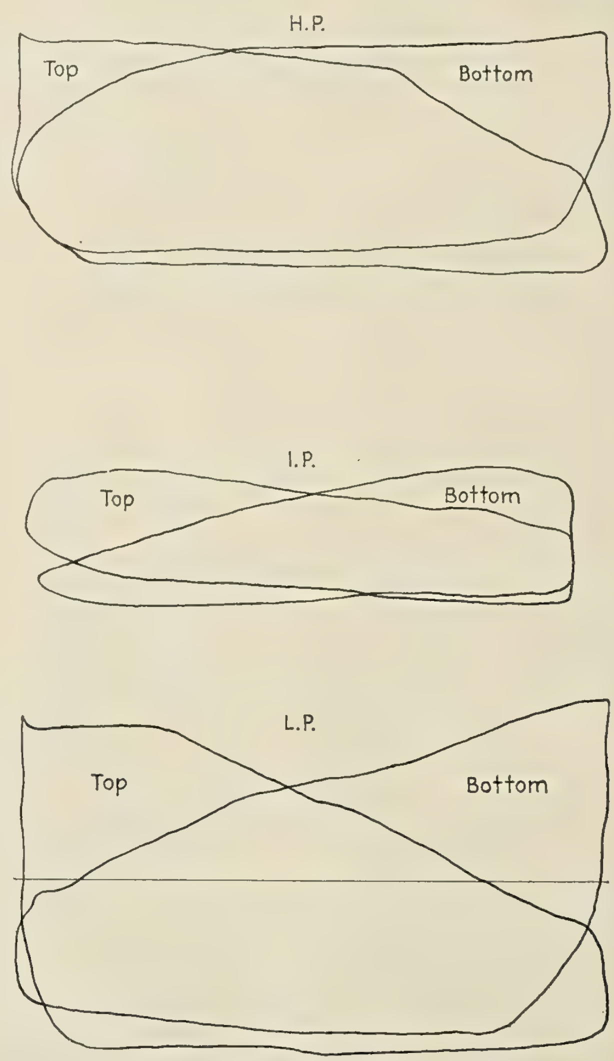
Valve Gear Setting

Q. (1170.)—What does the enclosed set of indicator cards indicate as to the valve gear setting and how should the valves be corrected? The engine cylinders are 27 inches, 44½ inches and 73 inches in diameter by 54 inches stroke. The steam pressure is 190 pounds per square inch.

A. (1170).—The comments which follow may be in error because of insufficient information and the faintness of the high pressure card. Certain assumptions had to be made, therefore, it does not seem safe to suggest changes either in the valve setting or to the valves.

High Pressure Cylinder.—Bottom release late as is also the bottom cut off.

Intermediate Pressure Cylinder.—Top card shows excessive compression and late admission. Bottom card shows late compression and early admission. The peculiar shape of the top right corner may be due to a leaky high pressure valve or a small receiver from the high pressure to the intermediate pressure steam chest, and the late high pressure



Set of Indicator Cards from Triple Expansion Engine

bottom release, steam coming to the intermediate pressure valve but little faster than it is being used, thus causing the horizontal steam line. Then the high pressure exhaust port begins to uncover more rapidly than the intermediate pressure steam port opens and pressure is built up in the receiver causing the steam line to rise.

Low Pressure Cylinder.—Both top and bottom cards show early compression and the bottom card late admission and release. The top card as a whole is not bad.

In order to study this problem for recommendations with any degree of assurance it would be necessary to know the order of the cranks and the side on which steam is taken for each valve, also the valve diagrams, if available.

Non-Shatterable Glass Introduced in the Marine Field

A NON-SHATTERABLE glass, manufactured by the Indestructo Lens and Windshield Company, Brooklyn, N. Y., which has found wide application in commercial service of various kinds, has been adapted to marine service. This glass is specially used for port lights where it is necessary to protect the ship against water damage. Wherever ordinary glass can be broken by wave action or other causes this indestructible glass may be utilized to advantage.

"Indestructo" glass is of laminated construction consisting of alternate layers of glass and pyralin welded into a solid homogeneous mass under pressure and intense heat. Vision is in no way impaired by the process and it is stated by the company that when the glass has been cracked through accident its structural strength is not materially decreased but can be continued in service indefinitely and afford protection against water damage. In tests conducted for Navy service the glass has been subjected to pressures up to 500 pounds per square inch without destroying the glass beyond usefulness. On naval vessels this glass is used almost exclusively; in merchant service it has been used for binnacle covers, gage glasses, battery boxes, glass doors and door windows, port lights, etc.

In reconditioning the *Leviathan* this glass is being used to replace the lights in 525 ports. "Indestructo" glass is being distributed by the Protective Appliance Company, 232 Vanderbilt avenue, Brooklyn, N. Y.

NEW BOOKS

The Welding Encyclopedia, Second Edition. Edited by L. B. Mackenzie and H. S. Card. A reference book on the theory, practice and application of the four autogenous welding processes. Size, 6 by 9 inches. Pages, 388. Illustrations, 550. Chicago, Ill., 1922: The Welding Engineer Publishing Company.

The first half of this book consists of a dictionary of all words, terms and trade names used in the welding industry. Included in this arrangement are instructions for welding operations on the most common types of repair work and production work, descriptions of the modern methods of testing welds, specifications for welding rods and wires for all classes of work, and descriptions of the application of welding to the various industries, such as automobile repairing, refrigerating machinery, structural steel, etc. Following the dictionary section are separate chapters on oxy-acetylene welding, electric arc welding, electric resistance welding and thermit welding. Complete descriptions of each one of these processes are given, followed by general operating instructions and special instructions for the application of each process to every metal which can be welded by it. Separate chapters are included on the subjects of boiler welding, tank welding, pipe welding and rail joint welding. Another section is devoted to the rules and regulations enforced by Federal and State authorities and insurance companies on the construction, installation and operation of welding equipment and on their application to various structures. A special chapter deals with the heat treatment of steel, one of the most important metals which the welder handles. A collection of charts and tables shows the variety of methods of preparing joints for welding, gives information on the characteristics of all the commoner metals, shows how to tell the temperature of metals by a color chart, and also shows a color chart explaining the proper adjustment of the oxy-acetylene flame. The catalogue section at the end of the book describes and illustrates the standard lines of welding equipment and apparatus.

Practical Guide for Diesel Engine Operators

Reviewed by A. J. C. Robertson*

Notes and Sketches on Marine Diesel Oil Engines. By J. W. M. Sothern, M.I.E.S., M.I.Mar.E. Size, 6 by 9¼ inches. Pages, 400. Illustrations, 230 (including many folding plates). New York, 1922: D. Van Nostrand Company.

Marine engineers generally are well acquainted with Mr. Sothern's previous books, "The Marine Steam Turbine," "Verbal Notes and Sketches for Marine Engineer Officers," etc., and this new volume is a welcome addition to this list.

In the new book Mr. Sothern covers practically all the phases of interest to the practical operating marine engineer who wishes to take up a study of Diesel engines with a view to being put in charge of these.

The book is divided into sections covering full descriptions of the various Diesel engines and their installation and practical operation, and also illustrating and explaining the various systems of starting gear in use, and the Diesel indicator diagrams and what they mean. Attention is also given in the book to the various auxiliaries in the engine room of a Diesel ship, and a number of questions and answers on Diesel oil engine practice are included which should prove of value to those taking examinations for certificates.

The section on indicator diagrams is particularly valuable as little information of this kind is at present available; the same might also be said of the article on fuel oil.

The book is splendidly illustrated by a large number of plans, sketches and large drawings, and is fully up to date, including such recent developments in Diesel engines as the Doxford and similar opposed piston engines, and the compound Still Diesel-steam engine.

In every way this book is a thoroughly satisfactory guide to a practical Diesel engine operator and should be in the hands of all those who contemplate taking charge of such machinery.

Very wisely the author has left out of his book the large and somewhat complicated question of heat stresses and the general questions of design such as propeller efficiency and revolutions and weights of the various types of engines as these are influenced by length of stroke, etc., and has confined himself to the information especially desired by those for whom the volume is prepared.

The Lloyd Sabaudo's new liner *Conte Verde*, sister ship of the *Conte Rosso*, was successfully launched at Glasgow, Scotland, on October 21. The Lloyd Sabaudo will place the *Conte Verde* in the New York-Mediterranean run beginning in the spring of next year.

*Naval architect, Munson Steamship Line, New York.

Captain William Lyons Made Commodore of American Hawaiian Fleet

Captain William Lyons was recently assigned to the command of the motorship *Californian*, at which time he was made commodore of the American-Hawaiian Steamship Company's fleet of twenty-one vessels. Captain Lyons became first officer of the American-Hawaiian steamship

Commodore William Lyons

Hawaiian in 1900 and has served continuously under the house flag of this company up to date. He was master of the steamers *Missourian* and *Montanan* when they were sunk by submarines during the late war. Under his command the *Californian* recently completed her maiden voyage of 21,000 miles from New York to the Pacific coast thence to Europe and return.

OBITUARY

Henry F. Miller, Philadelphia manager for Henry A. Kissel Company, dealer in ship supplies, recently died in that city following an operation. Mr. Miller was a member of the Maritime Exchange for many years representing S. P. Blackburn & Company and subsequently entered the employ of Kissel Company.

John R. Binning, manager for Canada and Newfoundland of Furness, Withy and Company, Ltd., recently died at Montreal at the age of fifty-six years. He was born at Hamilton, Scotland, and, after completing his education, was employed for a short time in the ship business in Scotland. He entered the service of the Canadian Pacific Railway in 1888 and ten years later became assistant manager of Furness, Withy and Company, Ltd., which position he held until 1903 when he was made general manager with headquarters in Montreal. In recognition of the service he rendered during the war, Mr. Binning in 1920 was appointed to the office of manager for Canada and Newfoundland.

PERSONAL MENTION

O. L. Smith, Jr., formerly manager of the Black Diamond Steamship Corporation's Baltimore office, has been promoted to the position of general manager of the Black Diamond Steamship Corporation at the head office in New York.

Arthur A. Grant, who resigned as vice-president and southern resident director of the Sinclair Refining Company with headquarters at New Orleans, has been appointed general manager of the Jahncke Dry Docks, Inc., of the same port.

Frederick I. Thompson, commissioner of the United States Shipping Board, representing the interests of the Gulf section, will retire from the Board within a short time. Mr. Thompson has recently become owner of the *Birmingham Herald*, which has made it necessary to give up his duties on the Shipping Board.

Captain R. L. Martin recently retired from the Robert Dollar Line after fifteen years' service, the last few years of which he served as marine superintendent at Vancouver. It is stated that he will organize a new shipping firm in association with Melville Dollar who has also retired from the Robert Dollar Company.

William Simmons, of the Simmons Transportation Company, the Jarvis Lighterage Company, Lee and Simmons, Inc., and a former president of the Maritime Exchange, was elected a commissioner of pilots at a special meeting of the Chamber of Commerce of the State of New York to serve for three years in place of Arthur M. Smith who died recently.

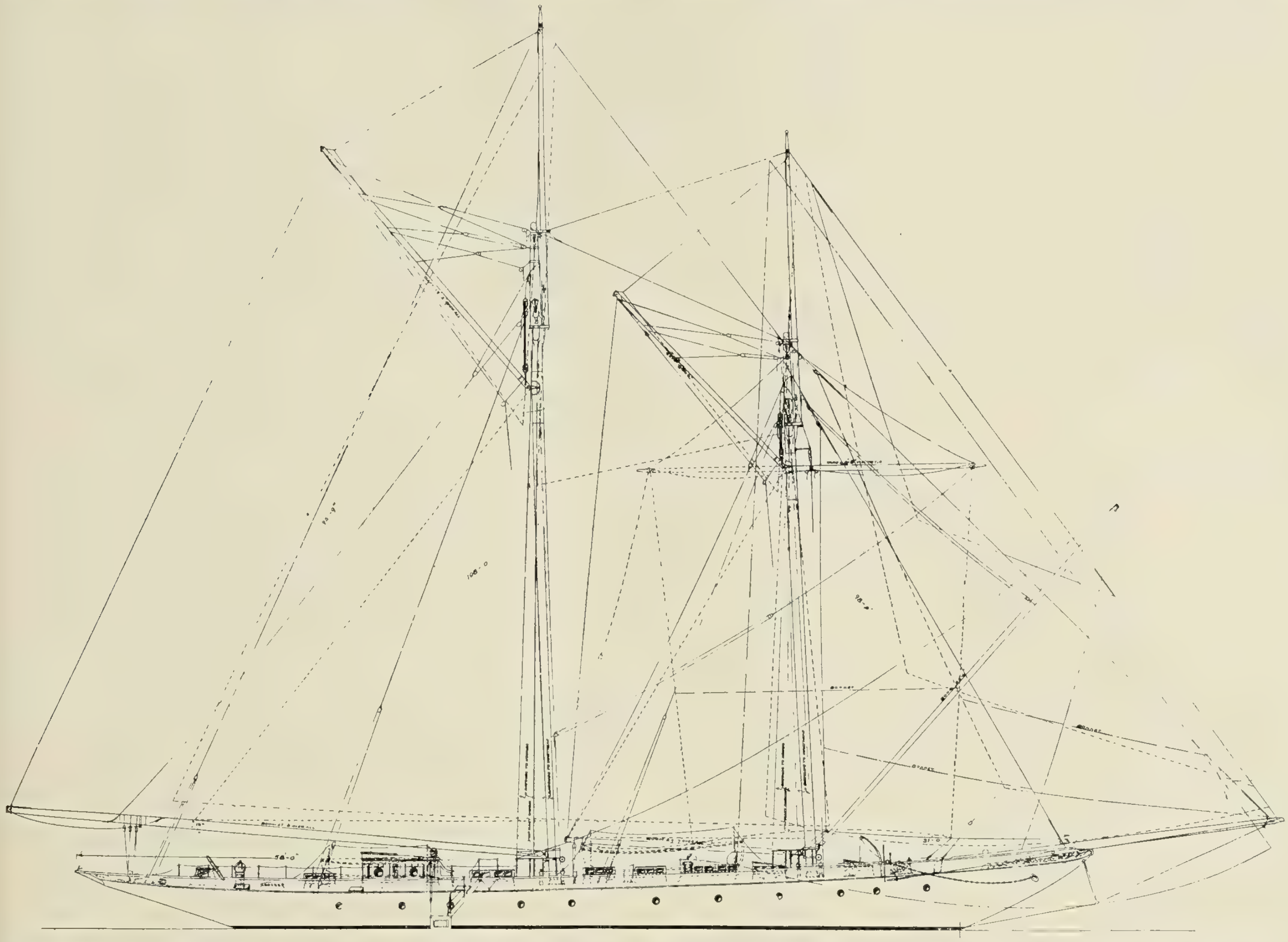
Hugo P. Frear, naval architect of the Bethlehem Shipbuilding Corporation, Bethlehem, Pa., and Ernest H. Rigg, naval architect of the New York Shipbuilding Corporation, Camden, N. J., have been appointed delegates to represent the American Marine Association at an informal conference on standardization called by Secretary Hoover of the Department of Commerce and to be held in the auditorium of the Grand Central Palace, New York, on Friday, November 10.

F. P. Guthrie, head of the radio division operating department of the United States Shipping Board Emergency Fleet Corporation, has been designated by Chairman Lasker as the representative of the Shipping Board and Emergency Fleet Corporation to serve as a member of the inter-departmental committee on electrical communications. Mr. Guthrie was a delegate to the Inter-Allied Communication Conference at Paris last summer. He has been with the Emergency Fleet Corporation since May, 1919.

R. Stanley Dollar, one of the largest stockholders of the Pacific Steamship Company (the Admiral Line) but who has not been active in its affairs, has been induced to take up his residence in Seattle, Wash., and to form a new company to be known as the Admiral-Oriental Line to which the Shipping Board allocated its ships running out of Seattle. Mr. Dollar, who is one of the most experienced operators in the Far Eastern trade, will hold the position of president of the new line devoting his entire time to the enterprise. A. F. Haines, who formerly managed the government ships for the Pacific Steamship Company, has been made vice-president of the new company. Mr. Dollar retains his interest in the Pacific Steamship Company, the present arrangement merely bringing all the government ships under the control of a company that will devote its entire time to their operation.

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry



OUTBOARD profile of two-masted steel auxiliary schooner designed by Theodore E. Ferris, naval architect and marine engineer, New York City, for William P. Adams, Esq., of Chicago, Ill. Vessel will be 125 feet over all, driven by oil engines, and bids for construction have been asked. She will cost about $100,000.

Contract for Another 12,000-Ton Steel Bulk Freighter Awarded Great Lakes Engineering Works

THE placing of another contract for the construction of a 12,000-ton steamer, as an addition to the bulk freight fleet, is the latest announcement from the Great Lakes district. The Great Lakes Engineering Works, of Detroit, Mich., is given as the successful shipyard, the new vessel to be built for the Cleveland-Cliffs Iron Company. Although official figures were not given, it is understood that the cost of the ship will be close to $800,000.

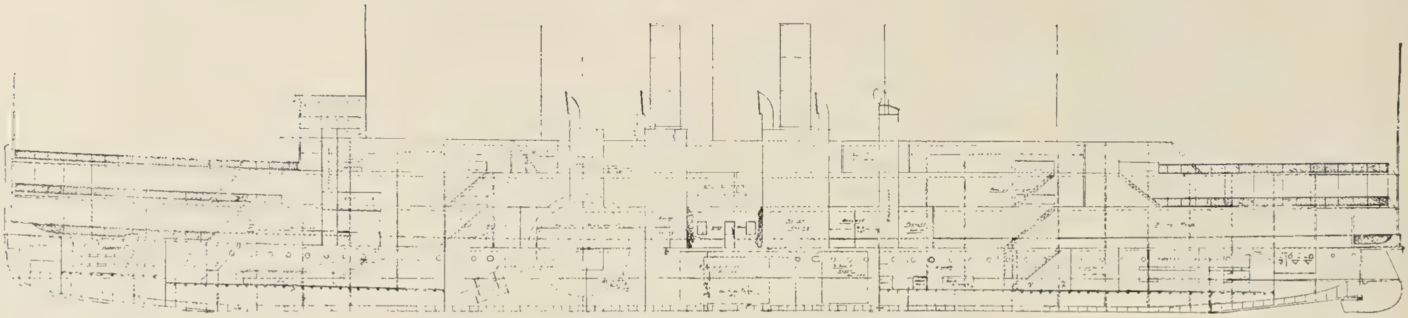
The new vessel will be a duplicate of the steamer *Pontiac,* of the iron company's fleet, being 600 feet over all length, 580 feet keel, 60 feet beam and 32 feet deep. She will be driven by a triple expansion engine, steam being furnished by three Scotch boilers.

This contract makes eight steamers of the 600-foot class that have been ordered since last May. Two of the boats will be built by the Great Lakes Engineering Works, five by the American Shipbuilding Company and one by the Toledo Shipbuilding Company. All the new boats will be operated in Cleveland. All the big freighters are for 1923 delivery except the steamer *James McNaughton,* which is building for the Wilson Transit Company by the Great Lakes Engineering Works.

Contract Reported Placed for the Red "D" Line Steamers

A PERSISTENT report in marine circles, credits the New York Shipbuilding Corporation with having been awarded the contract for the construction of one and possibly two new steel passenger and cargo ships for the Red "D" Line. While official information was withheld, there was a strong impression that the award has been made, the cost of each ship being unofficially estimated as in the neighborhood of $700,000. It is understood that propulsion will be by turbine engines.

The vessel will have an over all length of 320 feet, according to specifications issued recently, and will be of the two-deck shelter deck type, driven by twin screws.



Inboard Elevation of Proposed New Steamer

Specifications Prepared for Oil Burning, Side Wheeler to Be Added to Hudson Day Line Fleet

Vessel Will Have Length of 338 Feet, Propelled by Triple Expansion Steam Engines—Is to Have Two Single and Two Double Ended Scotch Boilers

PLANS and specifications were prepared by J. W. Millard & Brother, naval architects, 17 State street, New York City, for the construction of a new paddle wheel steel steamer for the Hudson River Day Line, bids having been received on October 20. The principal dimensions of the proposed steamer are length over all 338 feet, extreme breadth 76 feet, depth molded to main deck at side guard 13 feet 8 inches. The vessel will be propelled by a diagonal inclined triple expansion steam engine and she will be of a type equal to the steamer *Robert Fulton.*

Hull

The hull is to be built of steel on the transverse system and there will be two keelsons on each side of the middle line worked over the floors amidships. Tanks for the storage of oil fuel are to be built in the hull on each side in the forward boiler room.

There are to be five cylindrical fresh water tanks built of No. 12 B. W. G. steel plates, galvanized with single riveted seams and double riveted butt straps calked and made watertight.

Equipment

Chocks, cleats and fairleads are to be of cast steel of approved pattern similar to those on the steamer *Washington Irving.* There will be provided and fitted ready for use four pairs of davits for 22-foot lifeboats made of 3½-inch double extra thick steel pipe. The anchor davit of 3½-inch double extra thick steel pipe is to be complete with all fittings similar to that on the steamer *Robert Fulton.*

There is to be an American Engineering Company or other approved combination hand and steam power capstan located on the main deck forward. The capstan is to be fitted with a wildcat for 1-inch diameter anchor chain and to be large enough to handle the anchor and 7-inch lines.

Two approved hand deck pumps of brass of suitable size for the steamer, with their necessary sea and bilge valves and pipes, are to be fitted complete, as required by law.

The steamer is to have four metallic lifeboats of approximately 20 feet by 6 feet by 2 feet 5 inches; also one working boat 14 feet by 4 feet 6 inches by 1 foot 9 inches.

One 1,200-pound stockless anchor and one 600-pound stockless anchor with 60 fathoms, of 1-inch diameter, galvanized crane chain with proper shackles, etc., are to be supplied.

Machinery

The vessel will be propelled by paddle wheels of the feathering type, driven by an engine of the diagonally inclined, triple expansion, surface condensing type. The high pressure cylinder is to be in the center with one intermediate pressure cylinder on one side and one low pressure cylinder on the other. The general design of the engine and the character of workmanship and finish of all the machinery is to be like that of the steamer *Washington Irving.* The engine, in all its parts, is to be proportioned for a working boiler pressure of 180 pounds per square inch and 40 revolutions per minute. The paddle wheels are to be about 22 feet 5 inches in diameter, each having nine paddles about 12 feet 6 inches long by 3 feet 9 inches wide.

The main condenser will be separate from the main engine, built of wrought steel plate and will have about 5,800 square feet of cooling surface.

There will be one centrifugal circulating pump, worked by a vertical steam engine; a complete set of independent air, feed, sanitary, fire and trim tank pumps, electric light plant, steam steering engine, feed water heater, steam fan blowers for forced draft and ventilation, oil heaters and pumps, and such other supplementary machinery, instruments, etc., as may be necessary to make the installation complete.

Boilers

There will be two single ended and two double ended cylindrical, horizontal, Scotch type boilers to be allowed a working pressure of 180 pounds. Each boiler is to be 12 feet 1 inch inside diameter and 11 feet 4 inches length over top head for the single ended boilers and 22 feet over the top head for the double ended boilers.

Each single ended boiler is to have about 2,100 square feet of heating surface and each double ended boiled about 4,200 square feet of heating surface.

Each single ended boiler will have two furnaces and each double ended boiler four furnaces, 42 inches least inside diameter, and arranged to be taken out and revised without disturbing the boilers.

Fuel Oil Burning System

The steamer is to be furnished and fitted complete with the White Fuel Oil Engineering Corporation mechanical fuel oil burning system and there will be installed in the engine or boiler room two fuel oil pumps, three fuel oil heaters, duplex suction and discharge strainers, with all usual fittings.

Contract for New Steamer Awarded Bath Iron Works

A CONTRACT for the construction of a new passenger vessel for the New Bedford, Martha's Vineyard and Nantucket Steamboat Company, a subsidiary of the New England Steamship Company, has been awarded to Bath Iron Works, of Bath, Me. The new vessel will be a single-screw boat 200 feet in length, driven by a triple expansion steam engine.

Half A Million May Be Cost of Three-Ship Job

A HALF million dollar ship conversion job, involving three unfinished ships at Pascagoula, Miss., will be undertaken in the near future, according to latest reports from that city. The ships involved are hulls of steel construction, about 385 feet in length, built by the International Shipbuilding Company, of Pascagoula. They were originally intended for steam propulsion, one ship being so far completed that she will be finished as intended, the other two hulls, which are only partially completed, are to be equipped with Diesel engines.

Plans and specifications for the reconditioning work were prepared by Whittelsey & Whittelsey, naval architects, of 17 Battery Place, New York, tenders being received on Monday, October 16.

It is understood that the three hulls have been launched and were designed as cargo ships.

Steamer Covedale Will Be Converted to Oil Engines

BIDS have been received by the Munson Line for the conversion of the steamship *Covedale.* One of the two Scotch boilers now in the ship will be retained, as will most of the steam auxiliaries. New foundations for the engine and a number of new auxiliaries will be installed, the new propulsion to consist of one 900-brake horsepower McIntosh & Seymour Diesel engine, which was purchased by the Munson Line from the Shipping Board.

Tenders submitted October 5 were:

Tebo, $56,860, 58 working days.

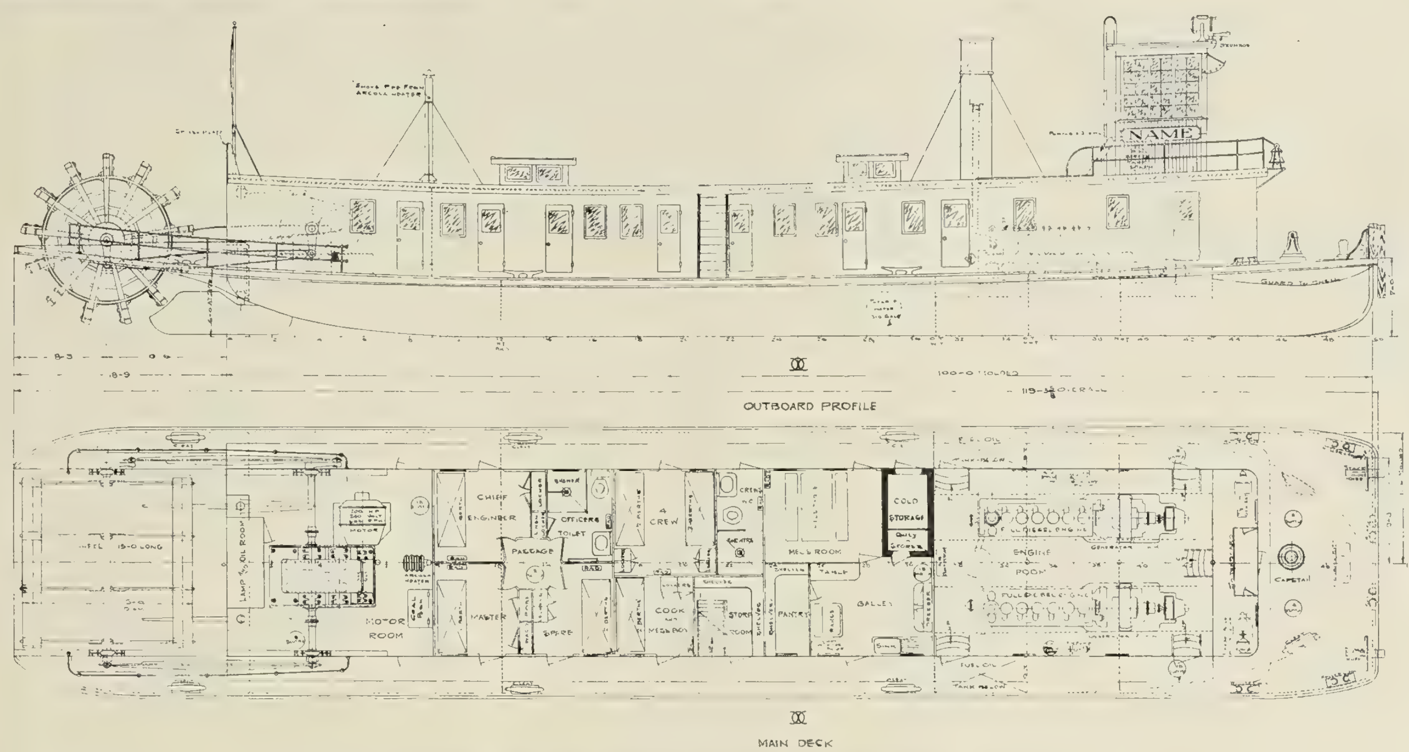
New York Harbor, $64,688, 50 cont. running days.

Federal, $68,000, 60 days.

Newport News, $68,000, 75 cont. running days.

New York Ship, $78,500, 90 running days.

Merchant Ship, $79,000, 14 weeks.



Profile and Deck Plan of Diesel-Electric River Tug

Charles Ward Engineering Works Submits Low Price for Building 100-Foot Diesel Electric Towboat

THE CHARLES WARD ENGINEERING WORKS, of Charleston, W. Va., submitted the lowest price for the construction of a 100-foot Diesel electric towboat for the U. S. Engineer Office, Mobile, Ala., at the opening of tenders on October 10. The Ward Company gave a price of $89,000 and 200 days, with Winton 6-cylinder 4-cycle main engines, Westinghouse main electrical machinery and Fawcas reduction gears.

The proposed vessel will have an over all length of 119 feet 3⅝ inches, breadth molded 23 feet, depth 5 feet, draft loaded 3 feet. She will be built according to American Bureau of Shipping Rules. Two Diesel engines are to be installed and they are to be a standard commercial product of American manufacture. Prices submitted provided for Worthington, Winton, McIntosh & Seymour and New London Ship & Engine Company types of main engines.

Two Tankers May Be Converted From Turbines to Diesels

GEORGE G. SHARP, naval architect, and marine engineer, of 30 Church street, New York City, has in hand a proposition for the conversion of two 7,500-ton tankers from geared turbine drive to Diesel drive. The engines to be installed are to be about 2,500 brake horsepower each.

Steamer Aztic Awarded Newport News Shipyard

ANNOUNCEMENT is made of the awarding of the contract for damage repairs on the steamship *Aztic*, to the Newport News Shipbuilding Company, on a bid of $14,643 and 12 days' time. Tenders were opened by Harald Nervik and R. Beylegaard, owners' representatives office, 59 Pearl street, New York. The prices submitted were as follows:

Sun Shipbuilding Co.......	$13,894	14 days
Tietjen & Lang............	14.110	17 days
Newport News Shipb'd'g Co.	14,643	12 days
Morse Dry Dock & Rep. Co.	16,000	17 days
Bethlehem Shipb'd'g Corp..	18,977	16 days

Three Contracts Awarded Johnson Plant, New Orleans

A CONTRACT to repair the damage caused by a hurricane to the United States Shipping Board tanker *Danville*, while the vessel was in Tampico Harbor, has been awarded the Johnson Iron Works, New Orleans, La., on a figure of $14,923.

The Johnson plant also has the Mississippi Warrior tug *Gypsum Prince* for repairs to machinery and hull, amounting to about $3,000. The Shipping Board steamship *Lake Clearport* was drydocked at the same yard for minor repairs.

Oil Conversion Job

The Joseph Frolich Iron Works, Inc., of New Orleans, La., has been awarded the contract to convert the tug *Panther*, owned by the Alexander Towing Company, of New Orleans, into an oil burner.

The Frolich Works is also busy with its two harbor floating repair plants, making repairs to the following ships: *Yumi*, of the Mexican Fruit Company; the *Ciba* and the *Caloria*, of the Vaccaro Brothers; the *Olancha*, of the Cuymel Fruit Company; the *Jacob Luckenbach*, of the Luckenbach Lines.

Buffalo Engineer Office Will Build Three Steel Scows

UNITED STATES ENGINEER OFFICE, of Buffalo, N. Y., will receive sealed proposals until 11 A. M. on November 6 for the construction of three 400 cubic yard steel dump scows. The boats are to have a length molded of 110 feet, breadth molded 32 feet, and unless otherwise specified, shall be built to the American Bureau of Shipping rules.

Contract Placed for Three Steel Bulk Oil Barges

A CONTRACT has been awarded the Alex Dussel Iron Works, of New Orleans, La., for the construction of two steel oil barges, 100 feet by 22 feet by 5 feet, with six compartments, and one 100 feet by 16 feet by 5 feet, with five compartments, for the Consolidated Company, Inc., of Plaquemine, La.; price $17,000. The company will fabricate the steel at their plant on Clio Street and assemble the boats on the river front.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Drydocked, New Orleans, La.—Tanker Danville, damaged by a storm, went to New Orleans to be drydocked.

Repairs to Steam Schooner, North Vancouver.—Steam schooner Fred Baxter went to Wallace Dry Dock to undergo repairs.

Motorship Drydocked, Galveston, Tex.—Motorship Whipple, of the Snyder Banana Company, went to Galveston to be drydocked.

Steam Schooner Drydocked, Portland, Ore.—Steam schooner Daisy Freeman went on drydock at Portland to install a new propeller.

Barge Drydocked, Chester, Pa.—The Atlantic Refining Company's motor barge No. 68, went to the Sun Shipyard, Chester, for repairs.

General Repairs, Jacksonville, Fla.—The Dio, consigned to Southern Shipping Company, went on drydock at Jacksonville for general repairs.

Schooner Drydocked, Portland, Ore.—The schooner Dauntless was lifted on the Port of Portland drydock for cleaning and painting the hull.

Steamer Repairs, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded repairs on the Shipping Board steamer Lake Giltedge.

Repairs to Tanker, Chester, Pa.—Tanker R. D. Leonard, of the Atlantic Refining Company's fleet, was drydocked at Sun Shipyard for miscellaneous repairs.

Steamer Inspection, Long Island, N. Y.—Steamer Medon went to Hunter's Point drydock to be inspected by representatives of the Alaska Steamship Company.

Steamer Reconditioned, San Pedro, Cal.—The Elabe, of the same company, went to the Los Angeles Shipbuilding and Dry Dock Corporation to be reconditioned.

Battleship Drydocked, San Francisco, Cal.—The dreadnaught New Mexico of the Pacific fleet went to the Hunters Point drydock to have new propeller blade installed.

Reconditioned for Lumber Trade, West Coast.—The El Cedaro, of the Los Angeles Lumber Products Company, will be drydocked soon to be reconditioned for the lumber trade.

Freighter Converted to Oil Burner, San Francisco, Cal.—Matson freighter Coverun went on ways at Bethlehem shipbuilding plant to undergo a change from coal to oil burning.

Steamer Drydocked, Seattle, Wash.—Steamship Queen, of the Pacific Steamship Company, went to Seattle to be drydocked for survey, as a result of damage made by grounding.

Negotiating for Tanker, San Francisco, Cal.—The Associated Oil Company, of San Francisco, is reported as negotiating for the purchase of a 4,000-ton tanker on the East Coast.

Conversion to Oil Tanker, West Coast.—Robert Dollar Line will convert the bark William Dollar into an oil tanker for the purpose of hauling fuel from the Pacific Coast to the Orient.

Lighthouse Tender Drydocked, Savannah, Ga.—Lighthouse tender Cypress went to the Wilkinson Machine Company to be scraped, painted and to have her engines thoroughly overhauled.

Repairs to Steamer, Mobile, Ala.—Shipping Board steamer Salvation Lass went to plant of the Alabama Dry Dock Company for minor repairs to her boiler, renewing a number of bad tubes.

Auxiliary Schooner Surveyed, Seattle, Wash.—The auxiliary power schooner Anvil went to Seattle to be surveyed as a result of striking Kelp reef and having her starboard bow considerably damaged.

Installation of Diesel Engines, Camden, N. J.—New York Shipbuilding Corporation will install Diesel engines on the steamship Jacksonville, purchased from the Shipping Board, and will offer her for sale.

Work on Barge, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded following work on the barge Oriole; installation of new boiler, together with necessary braces, hood, umbrella, stack, etc.

New Ferry Ordered, Detroit, Mich.—Great Lakes Engineering Works were awarded contract to build a ferry steamer for the Detroit-Walkerville route. She will have a capacity for forty-five automobiles and 2,000 passengers.

Cleaning and Painting Contracts, California.—Southern Pacific ferryboat Santa Clara went on drydock to undergo cleaning and painting and the Union Oil Company's carrier Oleum went on the Moore ways to also be cleaned and painted.

Reconditioning Contract, San Francisco, Cal.—The contract for reconditioning the two full-rigged ships, Arrapahoe and Edward Sewell, recently purchased by the Alaska Packers' Association, was awarded to the Moore Shipbuilding Company.

Scraping and Painting, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded contract for scraping and painting the tug Echo. Specifications also called for welding seams on front head of boiler and machinery repairs.

Repair Contracts, West Coast.—The General Engineering Company, of San Francisco, Cal., low bidder, was awarded general repairing work on three steamers, President Lincoln, Colombia and Wilhemina. Prices, in succession, $2,485, $595 and $158.50.

Shipyard Contracts, West Coast.—The Moore Shipbuilding Company, of Oakland, Cal., was awarded the following contracts: Steamers Floridian, West Katan, dredger San Pablo, steamers Covina, Coquille, tanker La Purisima and barkentine City of Sydney.

Barges Repaired, Mobile, Ala.—Barges Juniata and Susquehanna, of the Gulf Refining Company, went on the large dock of the Alabama Dry Dock & Shipbuilding Company. They require reconditioning of a number of shell plates, frames, rail stanchions, etc.

Steamer Drydocked, San Francisco, Cal.—Admiral Line steamer Admiral Schley went to Union Iron Works to be cleaned and painted. Bottom was scraped and cleaned, vessel to have two new coats of paint. Two new propellers replaced those already on the ship.

Repair Work, San Francisco, Cal.—The Moore Shipbuilding Company was awarded the following contracts: U. S. army transport Grant, to overhaul engines, etc., price $10,000; steamer Manukai, general overhauling, and steamers Edna and Alaskan, general repairs.

Repairs to Steamer, Quincy, Mass.—The Bethlehem plant at Quincy was awarded the contract for the following repairs to the steamer Calvin Austin, which went ashore in the Cape Cod Canal; replacing of stern frame, new rudder, keel plates and repairs to the forward section.

Steamer Reconditioned, New Orleans, La.—Contract for reconditioning United States Shipping Board steamer West Wauna was awarded to Jahncke Dry Dock Company. Overhauling included general repairs and furnishing and installing of a new set of Falk gears. Price $17,037.

Contract Awarded, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded the contract for installing a new rudder and miscellaneous bottom work on the towboat Montgomery and also for repairs to the towboat Demopolis, both of the Mississippi-Warrior Line.

Reconditioning Contracts, New Orleans, La.—The Johnson Iron Works was awarded the contracts for docking and repairs to Mississippi Warrior tugs, the Baton Rouge and Cairo, steamship Craster Hall, steamships Isabella and Manta, steamship Blue Hill, towboats Ruth and Cadmaus.

Painting and General Repairs, Mobile, Ala.—Gulf Refining Company's tug Senator Bailey went on dock of the Alabama Dry Dock Company for painting; installing new tail shaft; repairs around the hull and engine, including furnishing and installing new air pump to replace the one previously on board.

Barge Launched, New Orleans, La.—The Johnson Iron Works, Dry Dock and Shipbuilding Company, Inc., launched the last of the six barges to be sent to the United States Engineers at Mobile, Ala. The barges are made of steel, two having cabins, the last being 87 feet long, 28 feet 4 inches beam and 7 feet deep.

Contract Awarded, Brooklyn, N. Y.—Robins plant of the Todd Shipyards Corporation was awarded the contract for reconditioning the Texas Company's steel tanker Louisiana. In addition to reconditioning, Todd mechanical fuel oil burners and necessary auxiliary equipment will be installed. Price $100,000.

Tanker Repairs, Mobile, Ala.—Shipping Board steamer Duquesne was awarded to Todd Shipbuilding and Dry Dock plant, Mobile, for repairs, including installing of new set of reduction gears and extensive repairs on main turbines, necessitating removal from vessel of practically all propelling machinery.

Miscellaneous Repairs to Steamer, Chester, Pa.—Sun Shipbuilding Company was lowest bidder for contract to repair Japanese steamship Kashu Maru, damaged in collision. Sun yard bid $4,435 for repairs to counter, renewing several plates, fairing others, reconditioning steering gear and making miscellaneous repairs.

New Steel Barges, Pittsburgh, Pa.—American Steel and Wire Company has ordered twenty new steel barges from the American Bridge Company at a cost of $340,000. They are to be 175 feet long, twenty-six feet wide and eleven feet deep, and will be used for transport of coal and billets in the Monongahela and Allegheny rivers.

Repair Contracts, Hoboken, N. J.—The Tietjen & Lang plant of Todd Shipyards Corporation was awarded the contract for rebuilding the hull of the Mallory Line tug President; cost about $12,000. Same yard also reconditioned the ferryboat Syracuse and barges of the Clyde Line, Southern Pacific Company and D., L. & W. and Lehigh Valley Railroads.

Conversion Contracts, Brooklyn, N. Y., and Hoboken, N. J.—Contract for conversion of four ships of the Southern Pacific Steamship Company from coal to oil burning vessels was awarded to the Todd Shipyards Corporation; total cost about $336,800. Ships involved were El Siglo and El Cid, Robins Yard, Brooklyn, N. Y.; and El Dia and El Rio, Tietjen & Lang plant, Hoboken, N. J.

Steamship Overhauled, Camden, N. J.—Passenger and freight steamship Jacksonville, owned by the Merchants' and Miners' Transportation Company of Baltimore, was towed to yards of the New York Shipbuilding Corporation for extensive alterations to passenger quarters and a complete overhauling. She will probably be converted from triple expansion steam engine to Diesel-engine propulsion.

Reconditioning Jobs.—Bids submitted for repairs and reconditioning for three ships were as follows: Foreign Transport & Mercantile Corporation steamship Winnebago, Staten Island Shipbuilding Company, $4,721—33 days; United Fruit Ship Norma of Delaware, Morse Dry Dock & Repair Company, $14,650; and Baltimore & Carolina Steamship Company's steamer Tipton, Crook Shipyard, $212,790.

Installation of Boilers, Pittsburgh, Pa.—The Pearson Manufacturing Company received the contract to install a battery of three boilers on steamer National of the J. K. Davison & Brothers. They will be of the two-flue type, 38 inches wide and 26 feet long. The company also completed repairs to the boilers and machinery of the steamer Hibernia, owned by the Equitable Towing and Transportation Company.

Construction Contract, Amsterdam, Holland.—The Nederland Shipbuilding Company (Nederlandsche Scheepsbouw-Maatschappy), Amsterdam, have obtained an order from the Colonial Department for a cable-ship for the East Indies, named Zuiderkruis. The ship's dimensions are to be as follows: Length over all, 290 feet 10 inches; breadth molded 36 feet 9 inches; depth 22 feet 2 inches. The engine installation will be supplied by Werkspoor, Amsterdam.

Work on Great Lakes.—Great Lakes Engineering Works, Ecorse, Mich., was awarded the following contracts: Construction of 12,000 ton steamer James McNaughton; large amount of work on boats of smaller class; automobile carrier Fellowcraft, minor repairs; steamer M. G. Hausler, repairs to nine plates; tug Sidney T. Smith, to receive new stern and general overhauling; steamer Wesee and barge Harsen, for repairs; and seaplane, the Buckeye, engine overhauling.

SHIPYARDS AND DRYDOCKS

New Drydock, Staten Island, N. Y.—The new drydock of the New York Harbor Dry Dock Company, adjoining the new city piers, Clifton, S. I., was put in operation on Monday, October 16, a Standard Oil barge being the first boat to be lifted. The dock is 585 feet in length, 85 feet 7 inches wide between wings at bottom, 23 feet draft over keel blocks at low tide and will take ships up to 13,000 gross tons.

Plans Building Drydock, New Orleans, La.—The Algiers Dry Dock & Repair Company, of New Orleans, Edgar Berthaut, president, is planning to build a floating all-steel drydock capable of accommodating vessels up to 10,000 deadweight tons. The drydock will be 250 feet in length by 54 feet and will be operated by electric-driven centifrugal pumps. It is to cost about $400,000. The concern is contemplating increasing its capitalization to $500,000.

New Drydock, New Orleans, La.—The Algiers Dry Dock and Ship Repair Company, Inc., has been work on another floating all-steel drydock, capable of accommodating vessels up to 10,000 deadweight tons and plan to increase the capital stock of the concern from $100,000 to $500,000. The new dock, when completed, will be more than four times as large as the present dock, which is capable of receiving ships up to 2,000 tons, and will represent a cost of approximately $400,000, according to officials of the company. It is expected that the new dock will be completed by April 1, 1923.

PORT IMPROVEMENTS

Quay Walls, Montreal, Que.—Harbor Commissioners of Montreal awarded contract to Atlas Construction Company, Belmont street, for extending high quay walls between Sections 25 and 35, 4,500 feet long. Price $450,000.

Bulkhead, Chicago, Ill.—South Park Commissioners, Fifty-seventh street and Cottage Grove avenue, awarded the contract for 7,200 linear feet bulkhead to Great Lakes Dredge and Dock Company, 104 South Michigan avenue.

Contract Awarded, New York City.—The Morris & Cummings Dredging Company, 17 State street, New York, was awarded a contract by the Pennsylvania Railroad, Broad Street Station, Philadelphia, for dredging 180,000 cubic yards in South Amboy Harbor.

Contract Awarded, Norfolk, Va.—The contract for dredging the Norfolk channel to 40 feet in depth and widening to the eastward from the mouth to the junction of the Eastern and Southern Branches of the Elizabeth River, was awarded to the Fred E. Jones Dredging Company.

Developments of Harbor, Hamilton, Ont.—Hamilton Harbor Commission is having plans prepared for harbor front development and reclamation of land. Plans to proceed as soon as possible with first unit, costing $1,077,000, mostly reclamation work. Total, $13,000,000. A. Guy, chairman; E. V. Gray, city engineer; Gore, Nasmith & Storrie, Confederation Life Building, Toronto, engineers.

Harbor Improvements, Montreal, Canada.—Dominion Government, Ottawa, Ont., approved the following works for Montreal Harbor: Extending Jacques Cartier Pier 300 feet, $200,000; extending Alexander Pier 300 feet, $450,000; extending King Edward Pier 300 feet, $450,000; improving channel approach to Bickerdike Pier, $97,850; paving and extending Harbor Ry. terminals to new wharf levels, east of Section 25, $50,000. W. L. McDougall, chairman of Board of Harbor Commissioners; R. Harvie, chief engineer.

GOVERNMENT WORK

Barge, Montgomery, Ala.—Constructing Quartermaster, Montgomery, plans steel barge.

Catamarans, Savannah, Ga.—Constructing Quartermaster, Savannah, plans pontoon catamarans and pipe for dredge Morgan.

Pier Extension, Puget Sound, Wash.—Specification 4707—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans extending Pier 4.

Plans for Dredging, Puget Sound, Wash.—Specification 4708—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans dredging in Sound.

Barges, Florence, Ala.—U. S. Engineer awarded contract for 2 steel barges to Charles Ward Engineering Company, South Side, Charleston, W. Va. Price $34,000.

Dredge Pontoons, Etc., Mobile, Ala.—Penn Bridge Company, Beaver Falls, Pa., was awarded the contract for dredge pontoons and discharge pipe for U. S. Dredge Wahalak, by U. S. Engineer, Mobile. Price $28,903.

Steel Gates, Nashville, Tenn.—U. S. Engineer awarded contract to Penn Bridge Company, Beaver Falls, Pa., for steel gates for Lock F, Cumberland River. Price $22,783.

Barges, New Orleans, La.—U. S. Engineer, 329 Customhouse, awarded the contract for 2 steel oil barges in Mississippi River, to Midland Barge Company, Midland, Pa. Price $59,850.

Jetty Repairs, Jacksonville, Fla.—Waterfront Construction Company, Charleston, S. C., was awarded the contract for jetty repairs in St. Johns River, by U. S. Engineer. Price $5.87 per ton.

Catamarans, Portland, Ore.—The Williamette Iron and Steel Works, Portland, was awarded the contract for 80 steel pontoon catamarans for dredges Multnomah and Wahkiakum, by U. S. Engineer, Second District. Price $49,600.

Contract Awarded, New Orleans, La.—U. S. Engineer, 329 Custom House, awarded the contract for furnishing stone for Southwest Pass, Head of Pass and South Pass, Mississippi River, to O. F. Barrett, 2303 Grandview avenue, Cincinnati, Ohio. Price $216,480.

Contract Awarded, Philadelphia, Pa.—American Dredging Company, Mariner and Merchant Building, was awarded the contract for dredging in Delaware River on Bellevue, Cherry and Liston ranges, by U. S. Engineer, Witherspoon Building. Price $616,786.

Quay Walls, Etc., Pearl Harbor.—Specification 4591—Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded contract to E. J. Lord, McCandless Building, Honolulu, for quay walls and pier at Naval operating base at Pearl Harbor. Price $749,160; time 450 days.

Breakwater Construction, Indiana.—U. S. Engineer's Office, Room 1201, 537 South Dearborn St., Chicago, Ill., will receive sealed proposals for constructing concrete caisson breakwater at Indiana Harbor, Indiana, until 10 A. M., November 6, 1922. Further information on application.

Contract Awarded, Hampton Roads, Va.—Specification 4699—Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded the contract for riprap protection for breakwater pier at Naval Operating Base, to Arundel Corporation, Pier 2, Pratt street, Baltimore, Md. Price $150,000.

Dredging, Philadelphia, Pa.—U. S. Engineer, Witherspoon Building, awarded contract to American Dredging Company, Mariner and Merchant Building, for dredging in Delaware River, on Bellevue, Cherry and Liston ranges. Price $616,786.

NEW INCORPORATIONS

Yonkers & Alpine Ferry Company, capital $300,000, chartered at Albany. Incorporators: W. F. Dee, J. Williamson and J. Schwartz.

Donnelly Dry Dock Company, of Manhattan, capital $250,000, chartered at Albany. Incorporators: W. T. and N. E. Donnelly and D. W. Barnes.

The Susquehanna Line, of New York, capital $100,000, chartered under Delaware laws, to do steamship business. The Susquehanna Steamship Company operates Shipping Board vessels from New York and Philadelphia to Scandinavian and Baltic ports.

FOREIGN ACTIVITIES

Steamship Launched, Germany.—The new North German Lloyd steamship Werra has been successfully launched. The Werra will be used in the line's China service. She is a vessel of approximately 9,000 gross tons, with a 12½-knot speed, and will carry sixty cabin and 1,400 third class passengers.

Construction Contract, Amsterdam, Holland.—The Nederland Shipbuilding Company (Nederlandsche Scheepsbouw-Maatschappy) Amsterdam, have obtained an order from the Colonial Department for a cable-ship for the East Indies, named Zuiderkruis. The ship's dimensions are to be as follows: Length over all, 290 feet 10 inches; breadth molded, 36 feet 9 inches; depth, 22 feet 2 inches. The engine installation will be supplied by Werkspoor, Amsterdam.

Ship Construction, Scotland.—Announcement is made that the Commonwealth Government of Australia has ordered five passenger liners of 13,850 gross tons to be built on the Clyde for its service from London to Fremantle via the Suez Canal, including a stop at Colombo, Ceylon, which is reached in 20 days. A special feature of these ships is that with the exception of six cabins for 12 passengers, the whole accommodation is for third class passengers, totaling about 700.

Ship Contract, England.—Elders & Fyffes, Ltd., British subsidiary of the United Fruit Company, have placed an order with Cammell, Laird & Company, of Birkenhead, for two new ships. The vessels will be mainly for the transportation of fruit, designed to handle 100,000 bunches of bananas each and having limited passenger accommodations. Their capacity will be about 5,000 gross tons and will run in the company's service between the banana fields and the United Kingdom and Continental ports. The United Fruit Company some time ago announced the placing of orders for two Diesel engined ships for its American trade.

Trial Trip, Holland.—According to advices received by the Holland-America Line, the trial runs of the company's new twin screw steamship Volendam have been very successful. The steamer satisfied every expectation as to speed and maneuvering and has proceeded to the Holland-America Line docks at Rotterdam, where she will be finished. The Volendam is an oil burning passenger steamer of 15,550 tons register, 24,000 tons displacement, and is to be added to the New York passenger service of the company. She is equipped with all modern conveniences. The vessel is scheduled to sail from Rotterdam for New York on her maiden voyage November 4. Her return voyage from New York to Rotterdam, via Plymouth and Boulogne-sur-Mer, will be November 21.

Trials of Tankship, England.—The steamship Solen, one of several oil tankships built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., for the Anglo-Saxon Petroleum Co., Ltd., of London, has run successful trials. The speed attained during a series of runs on the measured mile was over 12 knots. The Solen will carry benzine in bulk and is built on Isherwood's system of longitudinal framing to Lloyd's highest class. Her dimensions are 427 feet in length, breadth 53 feet 4 inches and molded depth to the upper deck 31 feet.

Construction of 24-Inch Hydraulic Dredge Planned

PLANS and specifications are being prepared for the construction of a 24-inch hydraulic dredge for the United States Engineer Office, Room 405 Customhouse, Cincinnati, Ohio. The drawings and specifications are being worked up in the office of the Chief of Engineers, Washington, D. C., and it is expected they will be issued from the Cincinnati office in the near future.

BUSINESS NOTES

The Peabody Engineering Corporation has removed its office from 331 Madison Avenue to 110 E. 42nd Street, New York. They have taken considerably more space than their former office.

The Norman W. Henley Publishing Company, 2-4 and 6 West 45th Street, New York City, N. Y., will gladly send free to readers of Marine Engineering and Shipping Age a copy of their 1923 "Latest Catalogue of Practical and Radio Book," which they have just issued.

Lynn W. Nones has been appointed Eastern Manager of the Marine Department of the Diamond Power Specialty Corporation, with offices at 90 West Street, New York City. Mr. Nones was formerly manager of the Marine Department of the Griscom-Russel Company and was associated with them three and a half years. Previous to this connection Mr. Nones was with the Worthington Pump & Machinery Corporation.

The Babcock and Wilcox Company has established marine storerooms in Baltimore, Norfolk, New Orleans and San Francisco, through which proper material for B. & W. boilers may be obtained. In addition, they are establishing a marine storeroom in New York City, which will be stocked with spare and replace parts and tools. Orders placed in New York will be received at the company's office, 85 Liberty Street. For the convenience of its customers, the company has arranged a catalogue listing the various materials which may be required in connection with the operation of their boilers and may be obtained through the New York office or any of the storerooms.

TRADE PUBLICATIONS

Refractory Products.—The October bulletin of Laclede-Christy, St. Louis, Mo., contains articles on the value of clay products in the United States. The use of firebrick in glass plants, electric furnaces, metallurgical furnaces and the like.

Anti-Slip Tile.—A catalogue describing in detail a new non-slip tile for walking surfaces which is manufactured by the Carborundum Company, Niagara Falls, N. Y., is being sent out by the sales representatives, The American Abrasive Metals Company, New York.

"The Valve World."—The October issue of the Crane Company, Chicago, bulletin contains several excellent business and economic editorials and a special feature article of the City of Pittsburgh, its industries and buildings, with special reference to Crane service in this district.

Jahncke Dry Docks.—A pamphlet containing photographs and a description of the plant and operation of the dry docking facilities of the Jahncke Dry Docks, Inc., New Orleans, La., has been published by this company. Statistics are also given of the importance of New Orleans as a shipping port.

Diesel Engine Statistics.—A pamphlet containing diagrams compiled from "Lloyd's Daily Index" indicating the extent to which Burmeister and Wain Diesel engines are used in marine installations in direct comparison with the other types of marine Diesel engines has been sent out by Burmeister and Wain, Copenhagen, Denmark.

Marine Diesel Engines.—A complete illustrated catalogue of Werkspoor marine Diesel engines has been sent out by Werkspoor, Amsterdam, Holland. Details of the construction are given with special reference to unusual features of these engines. A special section is devoted to a description of the reversible propeller. A table of the standard size engines manufactured is also included.

Oil Coolers.—The multi-whirl oil cooler and the heat exchanger produced by the Griscom-Russell Company, New York, are illustrated and described in Bulletin 910 recently sent out by this company. Among other purposes, these types of equipment are designed for cooling oil in turbines, transformers and the like. Special reference is made to the use of this equipment in oil refining service.

Modern Floors.—A booklet intended to show the trend of modern practice in regard to flooring used in the construction of large buildings and the reasons for the success of present-day flooring methods is being distributed by the Marine Decking and Supply Company, Philadelphia, Pa. Details of the use of Lit-O-Sil-O flooring in various types of service with illustrations are given with a special section devoted to the use of this flooring aboard ship.

Malleable Nickel.—A resume of the properties and uses of pure malleable nickel is contained in Bulletin 101 issued by the American Nickel Corporation, Clearfield, Pa. The data are to a great extent tabulated and include the forms in which "American" nickel is produced, the purpose for which it is best adapted, its chemical and physical properties, the melting points of various metals, their specific gravities, standard gages for metal sheets and wire and other useful information.

Boiler Settings and Chimneys.—A bulletin outlining the service of Ballard, Sprague and Company, Inc., New York, in the construction of boiler settings, chimneys, steel stacks, and the like, has been issued for the benefit of those interested in boiler plant and industrial power plant construction and repair. Details of interesting stack construction jobs with numerous photographs, as well as boiler settings, acid towers and other types of construction are featured.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander S. M. Robinson, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City.
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

The New York Tow Boat Exchange
11 Moore St., New York.
Secretary—Irving G. Keller.

Port of New York Authority
11 Broadway, New York.
Chairman—E. H. Outerbridge.
Secretary—William Leary.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
President—H. H. Raymond.
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

Marine Engineering
and Shipping Age

Volume XXVII | December, 1922 | Number 12

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York
F. B. WEBSTER, Editor
H. H. BROWN, Managing Editor
L. S. BLODGETT, Associate Editor W. Z. GARDNER, News Editor

Contributing Editors
Rear Admiral C. W. Dyson, U. S. N. William T. Donnelly
Commander S. M. Robinson, U. S. N. H. McL. Harding
William Gatewood James L. Bates
Captain C. A. McAllister, U.S.C.G. (Retired)

WE GUARANTEE that of this issue, 5,050 copies were printed; that of these copies 3,779 were mailed to regular paid subscribers, 219 were provided for counter and news company sales, 200 were mailed to advertisers, 74 were mailed to employees and correspondents and 778 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 66,400—an average of 5,533 copies a month.

MARINE ENGINEERING AND SHIPPING AGE is a member of the Associated Business Papers, Inc. (A. B. P.), National Association of Periodical Publishers, Inc., New York Business Publishers' Association and the Audit Bureau of Circulation (A. B. C.).

Requests for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult, and often impossible, to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, please be sure to send us your old address as well as the new one.

The President's Message

THE pending shipping legislation has been considered of enough importance to the general welfare of the country to warrant calling Congress together in extraordinary session and the President, himself, has delivered a special message to that body outlining our shipping position as a problem of "grim actuality." As the President said, "We are facing insistent conditions, out of which will come either additional and staggering Government losses and national impotence on the seas, or else the unfurling of the flag on a great American merchant marine commensurable with our commercial importance to serve as a carrier of our cargoes in peace and to meet the necessities of our defense in war."

Although written in stirring language, this is indeed a practical statement and the whole message, in fact, is presented in a plain yet forceful way which should appeal more to our business faculties than to our sentimental aspirations. "Our immediate problem," declared the President, "is not to build and support a merchant marine, which I hold to be one of the highest and most worthy aspirations of any great people: our problem is to deal with what we now possess. Our problem is to relieve the public treasury of the drain it is already meeting."

Passing over the wartime cost of over $3,000,000,000 that we spent on these ships, the lives and treasure that were lost because of our impotency on the sea and the average monthly deficit of $16,000,000 that the Government suffered until the Shipping Board secured experienced operators, the President pointed out that the merchant marine, two-thirds of which is idle, still costs us $50,000,000 a year. "It is not, therefore, a question of adding new treasury burdens to maintain our shipping," he declared. "We are paying these burdens now. It is not a question of contracting an outlay to support our merchant shipping, because we are paying already. I am not asking your authorization of a new and added draft on the public treasury. I am appealing for a program to diminish the burden we are already bearing."

And the worst of it is that this annual expenditure of $50,000,000 is not getting us anywhere. On the contrary, it is an effective barrier against a permanent merchant marine under private ownership, for capital does not dare to enter into competition with Government-owned ships which, if the fixed charges, such as interest, depreciation and insurance, are taken into consideration, are costing us much more than fifty million dollars a year.

Depreciation, however, is constantly at work and it is this factor that makes it imperative to transfer the fleet to private ownership at the earliest possible moment. Many vessels are worthless now; all are deteriorating and under present conditions it is only a question of how long before it will be necessary for the United States, which 70 years ago had a merchant marine that was second to none, to acknowledge to the world that we cannot operate on the seas.

The President indicated three possible courses of action as follows:

"The first is constructive—enact the pending bill, under which I firmly believe an American merchant marine, privately owned and privately operated, but serving all the people and always available to the Government in any emergency, may be established and maintained. The second is obstructive—continue Government operation and attending Government losses and discourage private enterprise by Government competition, under which losses are met by the public treasury, and witness the continued loss and deterioration until the colossal failure ends in sheer exhaustion. The third is destructive—involved the sacrifice of our ships abroad or the scrapping of them at home, the surrender of our aspirations, and the confession of our impotence to the world in general, and our humiliation before the competing world in particular."

A choice among the three must be made and the President believes that the people demand the constructive alternative and that Congress will no longer sustain a program of ob-

struction. Subsidy, to many, is an offensive term, but the Government has aided other industries and the establishment of a merchant marine will be a means of benefiting the whole country. "If Government aid is a fair term," he said, "—and I think it is—to apply to authorizations aggregating $75,000,000 to promote good roads for market highways, it is equally fit to be applied to the establishment and maintenance of American market highways on the salted seas. If 'Government aid' is the proper designation for forty to fifty millions annually expended to improve and maintain inland waterways in aid of commerce, it is a proper designation for a needed assistance to establish and maintain ocean highways where there is actual commerce to be carried."

The fact remains that if it is called a subsidy then the fifty millions that we are now expending annually is also a

Copyright, 1922, by Star Company

An Insistent Call

—McCay in the *New York American*

subsidy. Under the pending legislation this expenditure would be cut approximately in half and there would be every opportunity to establish a merchant marine. No one can take advantage of the Government under the proposed bill because it provides that after 10 percent has been realized on the actual investment as determined by Government audit one half of all profits above that figure must be returned to the Treasury until the full subsidy has been returned. It is believed that when American genius has had an opportunity to establish itself in this business success will attend and that the outlay will be returned.

Other nations are naturally concerned about our shipping policy and it may be safely said that all maritime countries are opposed to this shipping measure. As Commissioner Plummer recently said, "It is under the best apple tree that you will find the most clubs," and considering that every ton of shipping that we put into commission is bound to displace a ton of foreign shipping, it is no wonder that other nations are concerned. Foreign shipping countries have a right to feel as they do, but what can be said of Americans upon whom the costly lessons of the great war have made no impression and who oppose an Act upon which the very life of the nation may depend.

There are still far too many who declare that in spite of the records of the last sixty years shipping can get along without Government assistance. They should heed the President's statement, that the head of a steamship company operating a fleet of ships had recently called at the executive offices to ask permission to transfer his vessels to a foreign flag. The reason given was that he could reduce his labor costs alone sufficient to provide a profit on the capital invested. Congress has also made shipping laws, to say nothing of applying prohibition to American ships, that are in need of immediate revision. To quote Chairman Lasker, our Attorney General Daugherty has outdone Moses as a law giver for the best that Moses could do was to make the Red Sea dry.

The proper American viewpoint according to the President is "from which one sees American carriers at sea, the dependence of American reliance in the event of war. Some of the costly lessons of war must be learned again and again. But our shipping lesson in the world war was much too costly to be effaced from this or the future generations.

"When people fail in the national viewpoint and live in the confines of community selfishness or narrowness, the sun of this republic will have passed its meridian, and our larger aspirations will shiver in the approaching twilight.

"But let us momentarily put aside the aspiring and inspiring viewpoint. The blunt indisputable fact of the loss of fifty million a year under Government operation remains; likewise the fast diminishing capital account, the enormous war expenditure to which we were forced because we had not fittingly encouraged and builded as our commerce expanded in peace. Here are the facts to deal with; not fancies wrought out of our political and economic disputes. The abolishment of the annual loss and the best salvage of the capital account are of concern to all the people.

"It is my firm belief that the combined savings of operations, losses and the protection of the capital account through more advantageous sales of our war-built and war-seized ships, because of the favorable policy which the pending bill will establish, will more than pay every dollar in Government aid for 25 years."

The New York *Tribune* calls the President's message "An Unanswerable Plea." It says, "Mr. Harding was at his clearest and best in his plea for the shipping bill. That fairness which is one of his most admirable qualities spoke throughout his argument. He presented the unquestioned facts of the situation and set forth the only possible courses of action. In reaching a decision he urged Congress to forget groups and parties and to solve the problem with an eye single to the welfare of the whole country."

Indeed, the President has made a plea that cannot be answered just the same as he has given us a plan to establish a merchant marine for which the opponents of the proposed shipping legislation can suggest no alternative. This plan is based on the facts and findings of the most expert maritime committees that could be gotten together. They were com-

posed of both Democrats and Republicans but no question of partisanship entered into their work. The House Committee on Merchant Marine and Fisheries has favorably reported and endorsed the subsidy bill. The President has spoken and now Congress, sitting in extraordinary session, must decide whether our trade will follow our flag to every port in the world or whether it will take such consideration as our maritime rivals feel disposed to give it.

Standardization

TOO much stress cannot be given to the importance of the informal conference on the subject of standardizing shipbuilding and ship operating practices and equipment held at the Grand Central Palace, New York, during "American Marine Week." From the discussion it was clear that only a well-defined plan of procedure is necessary to insure the co-operation of every organization in the marine field.

The next step, that of conforming with the resolution directing the formation of a committee on plan and scope and ways and means, should be taken with the least possible delay; but great care should be used in selecting the personnel that each phase of shipbuilding and ship operation be represented by men well qualified to act and that the Army, Navy and Shipping Board be included. The fact that the Department of Commerce, which was responsible for bringing about the conference, has pledged its support will go a long way toward insuring success to the movement.

The Star of Phœnicia

"BY night the richly freighted ships of the Phœnicians, skilled commanders of the commerce of the Ancient World, were guided into all the then known ports of men by the North Star.

"More than 3,000 years ago, the emulating Greeks, discovering the valued commercial purposes to which it was being put by these far famed builders of Tyre and Sidon, called it the 'Star of Phœnicia.' "

With this introduction, Mr. Edward A. Biggs, general counsel and vice-president of the Foreign Trade Division, Mississippi Valley Association, has written a brief outline of the history of world commerce entitled "The Star of Phœnicia." In this work he has proved, if the past is any criterion upon which the future may be known, that no country may expect to retain its place among the leaders of nations unless it develops and retains a profitable foreign trade.

It must be noted, however, that although Phœnicia, Greece, Carthage and even Germany acquired wealth and strength through foreign trade, this very trade has been the direct and indirect causes of the wars which resulted in their downfall. But America, unlike the countries of the Old World, is not open to the invasion of armies except they be transported over the sea. So our problem for insuring our safety and prosperity is simple in comparison. If we decide to go after the proportion of world commerce that we are really entitled to, that trade can be amply protected by an adequate merchant marine, that will guarantee safe and regular deliveries, and by a Navy second to that of no other country.

Mr. Biggs points out that "the Mississippi Valley is the granary of this nation as the valley of the Nile was the granary of Rome." It may be added that the surplus products of the manufacturing industry as well as agriculture in that section of the country amount to billions of dollars annually (foreign exports from the Mississippi Valley in 1920 amounted to $5,543,000,000). It ought therefore to be evident, if foreign trade is developed to take care of capacity production in the Middle West, that even if American ships carried every ton of exports and imports from one section of the seaboard, the Mississippi Valley would be the far larger gainer than the seaports through which their business flowed. And with the development of the internal waterways which this section of the country, having a majority representation in Congress, is bound to demand and obtain, and with the migration of seaboard industries which are now a thousand or more miles away from their raw products to the Middle West, which has been freely prophesied, the statesmen of the Valley would be blind indeed to their own interests if they allowed an annual expenditure of a few million dollars to stand in the way of an American merchant marine, the only vehicle that can guarantee the delivery of their products.

That they will not be so foolish is plainly shown by the passage of three Acts in the past few years which are solely designed to build up foreign trade. We refer to the Webb-Pomerene Act which provides that combinations for export trade which could not be formed under the Sherman Anti-Trust and Clayton Laws may engage in the export trade. Second, the Edge Law which provides the means of financing foreign trade. Third, the Merchant Marine Act of 1920 in which the country went on record as favoring any action that might be necessary to provide an adequate merchant marine.

Furthermore, as Mr. Biggs says, every man, woman and child in the United States is financially interested in our Government-owned merchant marine to the tune of $40 per capita. It is barely possible that through antipathy they might allow a fleet, that it cost $4,000,000,000 to construct, to be scrapped if it meant only the ships. But if these vessels are scrapped, it means that the machinery, equipment, etc., in other words the billions of dollars that we have put into added capacity for production for foreign consumption since 1914, must also be scrapped.

Annual Index Will Be Supplied on Request

THE annual index of MARINE ENGINEERING AND SHIPPING AGE will be published separately from the magazine at the end of the year. As the annual index will be useful only to those subscribers who have kept a complete file of the magazine for the year, only a sufficient number of copies will be printed to fill the orders received for it at this office on or before January 1. A copy of the index will be mailed without cost to each subscriber whose order for it is received on or before that date.

If the Shipping Bill Fails—What Then?

The Life of an Industry That We Must Depend Upon for Prosperity in Peace and Safety in War Is at Stake

By "Old Scotch"

EVERY good general before going into a fight makes plans for the possibility of a retreat. It makes no difference how confident he may be of victory, he always plans for contingencies which may arise despite his confidence and his well worked out problem of how to succeed. The better general he is, the more he thinks of what might happen if everything goes wrong. This looking ahead does not detract in the least from his chances of winning.

The advocates of the so-called subsidy bill are just now in the position where they should look ahead, and consider what would happen if the bill should fail. It will not hurt the chances of its passage, but on the contrary it may do some good, if we consider what we will then be facing, and consider it in such a way that we look the situation squarely in the face, and do not deceive ourselves regarding the cold facts which may then confront us.

The record of the past is the best harbinger of the future. If this proposed legislation should fail, we would be no better off now so far as governmental assistance is concerned than we were in the pre-war years, when our total merchant marine engaged in the foreign trade had dwindled to six or eight combined freight and passenger ships. As a matter of fact we will be worse off, because at that time world trade was in normal condition, with no cogs missing from the great wheel of producing commercial nations. If in pre-war years we could only keep these six or eight vessels going, what can be expected now when the ocean carrying trade is "shot to pieces" by the greatest period of depression on the seas the modern world has yet encountered?

Our Overseas Shipping

By means of the appropriation of fifty millions of dollars annually the Shipping Board has some four hundred vessels in operation in the foreign trade, which are carrying about one-third of our total exports and imports. They are extending our trade on various routes, protecting our shippers and importers from excessive carrying charges to the world's competitive markets, and incidentally keeping considerable money in circulation in the American repair yards, giving employment to a very respectable number of American officers and seamen, and helping other industries which are closely allied to ship operation. If the pending bill is not passed so that these ships can be placed in the hands of private owners, how long will this kind of government operation be kept up at a sure loss to the government?

With the axe of retrenchment being lustily wielded by the members of our national legislature, spurred on in their efforts as they are, by a tax burdened public, is it probable that such appropriations will be much longer continued for the operation of the government owned fleet?

Failure of Shipping Bill Means Government Ownership

If they are continued, the die will then be cast for the much dreaded government ownership and operation of transportation facilities on the sea. While such a procedure will be better than having no merchant marine at all, it must ultimately be doomed to failure, as many similar attempts are and have been in the world's history.

So long as the preclusion of foreign shipping from our coastwise trade is continued, we may be reasonably assured of a small merchant marine, but one that will be totally inadequate to prevent rate discriminations in our foreign trade, and to provide the absolutely essential merchant ship tonnage for our national defense. When we were drawn into the recent World War, it was pitiable to behold our helplessness for furnishing anything like the tonnage we needed for troop and supply transport to the European battlefields. Fortunately for us our allies were as deeply concerned as ourselves in getting our troops and munitions to the other side, and quite readily furnished us their ships, for which we paid and paid dearly. The bills for hiring foreign vessels for only a period of six months at the height of the war would have paid for the entire amount of the proposed subsidy to our own ships. Oh! if we could but remember some of our bitter experiences during that period of strife and learn some lessons from them. We never again should hypnotize ourselves into the belief that our coastwise tonnage would supply our needs for merchant shipping when we are faced with the inexorable demands of war.

What Would Become of Our Shipyards?

Let us look at our shipbuilding facilities in case this subsidy bill should fail. Even in these days of depression we still have a sufficient number of shipyards in operation to supply our needs for both commerce and national defense. The paltry contracts they now have in hand have been taken at ruinous rates, with the almost despairing desire of keeping their organizations together. All thoughts of earning overhead expenses and making any profits whatever have been abandoned at the present time. Hope of the passage of the subsidy bill is the only incentive the shipyards have for holding on.

In pre-war years there was sufficient naval work for the Government, handed out at ofttimes ruinous competition to keep a half dozen first-class shipyards busy, in combination with such small orders as they received for coastwise and harbor craft. The naval holiday has removed this sustaining part of their business for at least the next ten years.

Any one at all familiar with American shipyards, must and does know, that two such yards as the Newport News and New York Shipbuilding Company's plants could easily supply all the demands for new coastwise and harbor craft, working each at two-thirds capacity. What would become of the other yards now struggling to keep their heads above water? What would become of the thousands of skilled mechanics, and trained technical staffs connected with our shipyards, if they must depend on the meager amount of work necessary to keep up our coastwise and harbor craft demands for replacements?

Future of Our Repair Yards in the Balance

We have built up one of the most efficient systems of repair plants in this country, during the past five years, that can be found anywhere on the globe. If this subsidy bill fails, and we have no ships of our own in the foreign trade, what will become of them? It is true that shipping will always be coming to our ports, but foreign ships will never repair in American yards on account of the higher costs, due to our higher rates of wages. Such emergency repairs as foreign ships would have to make in American ports, in order that they may resume their voyages to home ports,

would not support one-tenth of the number of men now actually employed in American repair plants.

These repair plants are located everywhere that ships congregate and, unlike shipbuilding plants, are not confined to localities dictated by economic conditions. Thus we have important repair plants at Boston, New York, Philadelphia, Camden, Wilmington, Baltimore, Norfolk, Newport News, Charleston, Savannah, Tampa, Mobile, New Orleans, Galveston, Los Angeles, San Francisco, Portland and Seattle. Let the senators and congressmen representing states containing these shipbuilding and repair plants take heed that, if this vitally necessary legislation fails of enactment, their own communities will be very much affected, when the United States fails to maintain ships of its own in our foreign trade.

The ramifications of shipbuilding and ship repairs are so embracing that but few, if any, of our states will not be affected by the decline of this industry. Iron, steel, copper, lead, zinc, lumber of all kinds, cotton fabrics, rubber, hemp, cordage, coal, oil, paints, hardware, crockery and hundreds of other items enter into the construction and repair of ships. The thousands of mechanics employed must be clothed and fed, so that the raisers of cattle and food products of all kinds throughout the land are also very vitally interested.

The failure to pass this subsidy measure at this time means the practical destruction of shipbuilding and ship repairing in this country for the reasons hereinbefore pointed out. It has been a basic industry ever since the foundation of the country. Never before in our history has its very existence been so alarmingly threatened as it is at the present time, due to the peculiar conditions thrust upon us as an aftermath of the great war. No other industry is so important for our national safety in peace and war as is the art of shipbuilding. We cannot build ships when the art has been lost, nor can we buy them from abroad when war is threatened or at hand. Dives in the torments of the Inferno could place no greater value on water, than we would place on ships after, by our own negligence, we had lost the facilities to build them. The period when we allow our shipyards to close, for want of support, will mark our decadence as a virile nation.

The writer is firmly convinced that this session of Congress will see the enactment of the pending subsidy bill, as he has faith in the common sense of Congress, but it does no harm to consider, as has been briefly done herein, the dire results of its failure.

Maritime History Made at Brussels Conference

World-Wide Acceptance of Uniform Rules That Have Been Dominating Issues of Maritime Law Practically Certain

It is a pleasure to be in position to present our readers with the first official information to reach the United States as to the results of the history-making conferences on the unification of maritime law held at London and Brussels in October. The protocol is in French and was not received by Washington for translation before the first of December. The importance of the deliberations may be judged from the fact that twenty-four nations were represented at the Brussels Diplomatic Conference, and that agreed conclusions were reached on three of the four subjects discussed, and an initial agreement on the fourth. All that now remains in order to secure a world-wide uniform acceptance of the dominating issues of maritime law is for the several Governments to endorse the findings of the Conference—an eventuality that is practically certain.

The Brussels Conference, which was the final and conclusive one, was held on October 17-26, with fifty delegates present. The subjects before it were:

(1) Limitation of Shipowners' Liability.
(2) Maritime Mortgages and Liens.
(3) Contracts of Carriage by Bills of Lading.
(4) Immunity of State-owned Ships.

The agreements were as follows:

Limitations of Shipowners' Liability

Instead of freight and accessories as the measure of liability added to the value of the ship, with the consequent difficulty of investigation and the chances of litigation, the solution arrived at is ten percent of the value of the ship *at the commencement of the voyage.* This ten percent will include some accessories. Thus the freight of the tramp is put on the same proportionate plane as that of the liner. In case of loss of life, the personal liability on the part of the shipowner will be £8 per ton; thus the total measure of liability is fixed at the value of the ship plus ten percent with the provision that in event of loss of life there shall be a separate fund up to £8 per ton for claims in respect of loss of life or personal injuries. This would give life claims in the United States important rights they have never enjoyed, and cargo claims will only be limited by the occasion instead of by the voyage.

Maritime Mortgages and Liens

The only liens having priority over a mortgage are: (1) law costs, taxes, port dues, etc.; (2) wages; (3) salvage; and (4) collision and negligence claims. Masters' disbursements and bills of lading claims are both postponed to the mortgage. In order to prevent injustice to the postponed lien creditor an article was added that notice of the mortgage should be inserted by the official responsible on the ship's papers; and conversely a provision was inserted that in regard to liens for masters' disbursements and bills of lading, claims should only take precedence of the subsequent mortgage, if notice of the lien be given to the registrar of mortgages within three months.

Contracts of Carriage by Bills of Lading

This is the new title for what has been familiarly known as "The Hague Rules." They have been so frequently discussed in Marine Engineering and Shipping Age as to be generally understood in the form in which they came up before the Brussels Conference. That form passed practically unaltered, with two important exceptions. Article III, Rule 6, limits the time to one year instead of two, after delivery of goods or the date when goods should have been delivered, in which the carrier and the ship shall be discharged from all liability in respect of loss or damage unless suit has been brought. The limitations thus prescribed shall not be applicable, if the condition of the merchandise has been contradictorily agreed upon at the time of its receipt. Notice of loss or damage may be given at the port of discharge to the carrier or his agent at the time of the removal of the goods into the custody of the person entitled to delivery, if such loss or damage is apparent; if loss or damage be not apparent at the time of delivery, three days extra are allowed for notice. The phrase "prima facie," so familiar to Anglo-Saxon legal procedure, was vigorously opposed by

the French delegates, and in its stead was employed a more verbose expression which means exactly the same thing.

Article IV, Rule 4, which has to do with deviations, was completely changed. It was finally agreed upon in the following terms: Any deviation in saving or attempting to save life or property at sea, or any reasonable deviation shall not be deemed to be a breach of this convention or of the contract of carriage, and the carrier shall not be liable for any loss or damage resulting therefrom.

Immunity of State-owned Ships

This is the subject upon which complete agreement could not be obtained at the moment, because, although a resolution on the subject had been unanimously passed at the London Conference of the Comité Maritime International the week before the Brussels Diplomatic Conference met, time was wanting to bring the matter officially to the notice of the various Governments, and the consequence was that the delegates came to Brussels without the necessary instructions that would permit of their signing. It will, therefore, have to wait upon future action.

However, a substantial basis for action lies in the resolution adopted at the London Conference and which reads as follows:

(1) Sovereign States in regard to ships owned or operated by them and cargoes owned by them and cargoes and passengers carried on such ships ought to accept all liabilities to the same extent as a private owner;

(2) Except in the case of the ships and cargoes mentioned in paragraph 3 such liabilities should be enforceable by the tribunals having jurisdiction over and by the procedure applicable to a privately-owned ship or cargo or the owner thereof;

(3) In the case of:

(a) Ships of war;

(b) Either vessels owned or operated by the Sovereign States and employed only in Government non-commercial work;

(c) State-owned cargo carried only for the purpose of Government non-commercial work on ships owned or operated by the Sovereign State.

Such liabilities should be enforceable by the like tribunals, but only of the State by which the ship is owned or operated, and should be enforceable by action "in person" as against such State, and in addition by any other form of procedure permitted by the law of such State.

The Value of Tramp Steamers to a Merchant Marine*

Wonderful Success of British Marine Is Due to Her Pluck, Vision and Determination in Building and Operating Tramp Steamers Reaching Out to All Ports of World

By C. H. Potter†

There exist today four distinctive types of steam vessels; first, the combination passenger, mail and express type; second, the general cargo type, trading between United States and foreign ports maintaining definite sailing schedules; third, the tank type, employed in carrying oil in bulk; and fourth, a type known in the shipping trade as the "tramp." The tramp type differs from the cargo liner in that it does not maintain regular sailing dates. Its function is principally to carry bulk cargoes such as coal, ore, grain, lumber, phosphate rock, sulphur, etc. It serves as a medium for relieving freight congestions, and in the past has been the medium whereby many regular berth operations have been established and maintained.

For years prior to the war in 1914 we had no merchant marine employed in foreign trade that was worthy of being called a merchant marine. A few lines were fighting for their very existence under the American flag running between American and foreign ports, but it was hopeless without adequate financial assistance from our Government as an offset against the low operating and capital costs of the competing foreigner. True, we had and still have a splendid coastwise fleet, but I am discussing at this time foreign trade.

For years, statesmen and others who were in close touch with foreign and domestic affairs warned us that a merchant marine was essential to our very being; that our shipyards should be built up; that no nation could continue to be great that did not possess and maintain a real merchant marine, and yet in the face of these repeated warnings we drifted along, doing nothing that was constructive. Congress enacted laws that put added burdens on shipping, increased the cost of operation, destroyed initiative and made it difficult to induce capital to tie up with the shipping industry.

Government Policy Has Changed

To further illustrate and emphasize the weakness of our merchant marine prior to the war, you will recall when President Roosevelt ordered our fleet of battleships around the world it was necessary to employ foreign steamers to carry coal and other supplies for the fleet. This concrete example of our weakness should have inspired us as a nation to support a merchant marine, but we drifted along, little realizing that a day of reckoning was ahead. Again, it was no unusual occurrence for the Navy Department to charter foreign flag steamers to carry coal to the various naval stations in the Pacific, to Cuba and the Panama Canal, for the reason that the foreign steamer carried it cheaper than the American. Surely this was a destructive rather than a constructive method of building up a merchant marine. Happily, however, the Government's attitude has changed, and I am glad to state that it is doing everything possible to employ and encourage its merchant marine.

Possibly we can profit by reviewing what other successful maritime nations have accomplished in the building and developing of their tramp steamer tonnage. England, for instance, is a living example.

The wonderful success of the British marine is due to her pluck, vision and determination in building and operating tramp steamers reaching out to all parts of the world, opening up trading posts, establishing and maintaining other avenues of communication. Not only do they carry merchandise to and from British and Colonial ports, but to and from ports of other nations, our own included. And what is true of England is true of other foreign nations,

*Address delivered at Marine Exposition, New York, November 11, 1922.
†President, Maritime Association of the Port of New York.

especially Norway and Japan. They have made wonderful progress. England's tramp tonnage, I am told, represents 60 percent of its total merchant fleet.

During the war we constructed some fourteen hundred steel steamers—a great and mighty fleet of various types built in American shipyards by American citizens. The bulk of these steamers are at present tied up in our various seaports. Many of these steamers are suitable and available for tramp service, dependent, of course, upon their ability to operate as cheaply as foreigners, which at present cannot be done for the very good reason that the capital cost and our standard of wages and living will not permit it.

Widely Distributed Ownership Desirable

Another factor which has contributed toward the development and success of foreign tramp tonnage is due to the distribution of ownership among the masses rather than among a few corporations. The effect of this distribution of ownership tends to create interest and enthusiasm for the merchant marines of their respective countries.

Congress has appropriated vast sums of money to carry out the provisions of the Jones Bill; through the Shipping Board it has encouraged and developed the passenger liner and cargo liner, and rightly so—but tramp operation has received no support nor encouragement. Figures which I have in my possession substantiate this statement. Since January 1, 1922, there cleared from our United States ports one thousand and three foreign tramp steamers with bulk cargoes and only two hundred and twenty privately owned American steamers with bulk cargoes.

Senator Wesley L. Jones, in giving his views in regard to the tramp steamer, states "that, while the Merchant Marine Act of 1920 does not specifically refer to this particular type of vessel, it should be taken for granted that tramp steamers would be one of the main parts of any adequate merchant marine, and notwithstanding that the Shipping Board is directed in respect to shipping routes and steamship lines, there is no warrant for the board's concluding that tramp steamers are not an integral part of an adequate merchant marine."

Therefore, it is fair to assume that it was not in the minds of the framers of the Jones Bill that private companies could operate and compete with foreign steamers without receiving financial assistance in some form from the Government. Comparative figures disclose that it costs 25 to 30 percent more to operate an American tramp steamer than it costs a foreign steamer of like tonnage. This fact alone should be convincing proof that a subsidy is necessary for the development and maintenance of our merchant marine.

Same Principle Applies to Foreign as to Coastwise Trade

I hear some say, why worry about it? If foreign steamers will carry our imports and exports cheaper than American steamers, let them carry it. Then, why not go further and apply that same principle to our coastwise trade? For example, take one particular branch of our coastwise trade—I refer to our intercoastal trade. Today we have about 80 of the finest cargo steamers afloat averaging ten thousand deadweight tons, carrying general cargoes between Atlantic and Pacific coast ports via the Panama Canal, giving employment to a large number of officers and men. Again, why not continue to have foreign colliers and supply vessels trail our battleships and carry coal and oil to our naval stations? That has been done, and in peace times. Put these questions to our citizens and I venture their reply would be almost unanimous in favor of protecting our coastwise trade and against employing foreign ships to carry coal and other supplies to our naval stations. This service should be performed by our tramp steamers.

The point I wish to emphasize is that this protection to our coastwise fleet is in reality a form of subsidy—transportation of Naval coal and supplies in American vessels costs more than a like service in foreign bottoms and therefore takes the form of a subsidy.

It is gratifying that the present proposed subsidy bill provides for compensation to the tramp type of steamer—and to my mind the subsidy bill, if enacted, will revolutionize our merchant marine.

Shipping at Critical Period

Without national aid our merchant marine cannot exist. We are at a critical period, and it now rests with Congress as to whether or not we shall have a merchant marine worthy of this great nation.

In case of war we need large fast steamers for scout ships and for carrying troops. We need cargo liners and tramp steamers to carry supplies for the Navy and base supplies—in both instances they are indispensable—and more, in peace times we need all types—passenger and freight, fast and slow—for the proper development of our world trade. We don't ask for it all, and never did, but we have the right and should demand our fair share.

My hope is that Congress will adopt a subsidy bill that will make possible the development of a merchant marine suitable for national defense in case of war, and, in times of peace, to develop and maintain avenues of trade. Also, that Congress will revise our navigation laws insofar as they tend to obstruct and destroy the healthy growth of our merchant marine.

To sum up—the tramp steamer is valuable and essential:

(a) as an auxiliary aid for national defense purposes
(b) as a medium for the development of our Naval Reserve
(c) to transport coal and other supplies to naval stations and naval vessels
(d) as a merchant vessel to transport bulk cargoes
(e) for relief expedition purposes
(f) for relieving freight congestions
(g) as a pioneer for establishing a regular berth service
(h) as a medium to prevent profiteering

With adequate financial Government aid spread over a term of years or until the merchant marine can be stabilized and made self-supporting, plus American genius, initiative and perseverance, unhampered by Government red tape and wastefulness, I make bold a prophesy that we as a nation will witness the dawn of a new era in our shipping industry, and that in due time we shall have builded on the foundation already laid, a permanent merchant marine worthy of this great and glorious nation.

(Photograph by Kadel & Herbert, N. Y.)

Radio and Wireless Room on the Italian Liner Guilio Cesare

Simplified Practice as a Service to American Shipping

Address Delivered at Informal Conference on Standardization of Shipbuilding Equipment at Marine Exposition, New York, on November 10

By Ray M. Hudson*

YOUR chairman has stated the purpose of this conference. Let me supplement his remarks by saying there is nothing in which I have to offer as Secretary Hoover's representative that suggests government interference, restriction, regulation or control. You all know the Secretary is a firm believer in "less Government in business and more business in Government." Mr. Hoover's major interest in this meeting (made possible through the good offices of Colonel Simmons of the American Marine Association of which he is president) is along the line of waste elimination and it is entirely from that angle that I will present this message from my Chief regarding "Standardization, and its possibilities for greater usefulness to the marine field."

A few weeks ago during a trip along the Philadelphia waterfront, I saw eight warships, and one hundred and twenty destroyers, and other fighting craft tied up in the basin of the League Island Navy Yard. A little farther along, at Hog Island, I saw nearly one hundred and fifty cargo carriers, anchored row upon row. The contrast between that scene, and the one I saw at the same place four years ago, is a fit subject for a master in the art of graphic description. But being an engineer, instead of a novelist, or an artist, I could only make inward comment on the great change occurring in so short a time in the economic conditions of our country. Since a similar picture is possible in several of our harbors, the coincident idleness of both those great fleets is—or, at least, should be—a matter of deep concern to every business man in America, for in their present state, they represent a huge, economic waste—a waste that is not measured in terms of depreciation and interest on the tremendous investment represented—but instead is measured in the ever-increasing loss of the useful service they might well be performing in the promotion of trade, industry and transportation of these United States! The crudest evaluation of that staggering loss should challenge us all to a degree of concerted action in behalf of the American merchant marine!

This great annual Marine Exposition, which we are privileged to attend, is a splendidly organized piece of publicity, which will accomplish much toward arousing the American public, not only to a better appreciation of the magnitude of the shipping industry, but more than that—to a better understanding of the vital importance of a successful merchant marine as a factor in the future growth and prosperity of America. But with all due credit for this mighty effort, which recognizes that "well-begun is half-done," there is yet a vast amount of work to be done within the industry itself, before the people will believe that the returns on the investment will warrant their cooperation and support!

For example, what opportunity is there within the industry for further refinement of ocean transportation? Are there any avoidable wastes in current construction, operation and maintenance practices? If so, to what extent do they exist, and what would be the effect of their elimination on present costs? Are we now making full use of the best thought and experience within the industry? Is it possible to simplify methods both commercial and engineering beyond their present status and, if so, would the results justify the effort from a dollars and cents standpoint?

Unless the shipping industry is totally unlike our many other industries, there is in it, as in the others, a real need for rigid self-analysis and a careful determination of all existing uneconomical practices which add cost but which do *not* increase the volume of business done or enhance the quality of the service rendered.

Waste Disclosed in Industries

When Secretary Hoover was president of the American Engineering Council, he directed a survey of waste in industry. Six major industries were carefully studied, and the relative waste, considered in the light of the best practice then existing in the industry, ranged from 28 percent in the metal trades to 64 percent in the men's clothing manufacturing, or say an average of 40 percent of all effort *lost* or spent without a tangible or definite return. As a result of this survey, which might well be called "the Alarm Clock of American Industry," there has developed a widespread community of interest in the general problems of increasing production, securing a more sensible distribution of demand throughout the year, improvement of organization and executive control, and the application of the principle of standardization to products, to materials, to the equipment and also to the performance of the labor by which these are produced!

All of this effort is predicated on the belief that concerted action toward the elimination of waste will lower costs, broaden markets and yet maintain the high standards of American living through providing a fuller measure of this world's goods for the same expenditure we now make.

Purpose of Division of Simplified Practice

The Secretary has organized our Division of Simplified Practice to assist the industries in the solution of their problems of this nature, believing that the facilities, the moral weight and the prestige of the Department of Commerce will facilitate constructive action. It is not our thought, or purpose, to pose as experts in any field; the only experts we know are those we find in the particular field under consideration. Those of you who heard the paper on "Standardization" by Mr. E. H. Riggs, before the Society of Naval Architects and Marine Engineers, had the pleasure of hearing a real expert in the matter. His summary of the standardizations already achieved and practiced within the industry shows both sides of the question in a comprehensive manner. We fully agree with him that the question before us today is *not* one of the intrinsic merits of the principle, but rather a question of the *extent* to which it can be, and will be, applied by you all. In reviewing the membership of the American Marine Association, we find there are many firms who are members of trade associations now carrying on definite simplification programs for the good of the industry they represent. Our Division is participating in the work and can point to simplifications achieved in two major fields—surveys for possible elimination of excessive and unnecessary sizes and varieties going on in sixteen other fields, and contacts with nearly a hundred other industries—that believe that simpli-

*Division of Simplified Practice, Department of Commerce, Washington, D. C.

fied practice offers them advantages and benefits well worth obtaining.

What Simplification Is

Now just what is "Simplification"? Let me state it in Secretary Hoover's own words:

> "It is certain that there are a great many articles of every day use in which the manufacturer would be glad to undertake some cooperation in standardization, from which the saving in national effort would be interpreted, not into *millions,* but into *billions* of dollars! This does not mean that we stamp the individuality out of manufacture, or invention, or decoration—it means basic sizes to common and every day things."

Just think for a moment what would be the result of such a cooperative effort among all the elements of the shipping industry here represented! Suppose that in the many items used in ship construction there existed a much greater degree of standardization than now prevails. Is it not conceivable that construction costs would be lowered considerably? The manufacturers of equipment, parts and fittings would be enabled to work more along the lines of mass-production than the present system of highly *individual,* specialized construction permits. As a consequence, the shipbuilders would have a greater flexibility of supply, a lower purchasing cost and would further benefit through lessened assembling or installation costs, as well as in a shortening of the total period between the final authorization of the plans and the delivery of the completed vessel.

Greater standardization made possible through simplification also means lower maintenance costs, for standardized parts are not only more readily procurable and more quickly interchanged for worn or broken parts but their use means large direct savings and even greater indirect savings, due to the consequent reduction of idleness or "stand-by" charges.

Standardization Reduces Cost of Transportation

Standardization has been, and still is, a very important element in reducing the cost of transportation. Back in 1867, when railroading in America was yet in the early stages of development, a group of far-sighted, practical-minded men formed the Master Car Builders' Association, for the "advancement of knowledge concerning the construction, maintenance and service of railroad cars and parts thereof." Another object of the association was "to provide an organization through which the members, and the companies they represented, could agree upon joint action to bring about uniformity and interchangeability in the parts of railroad cars." Today, the American Railway Association, which absorbed the Master Car Builders' Association, publishes a "Manual of Standards and Recommended Practice" covering: Specifications for Materials, Fundamentals and Details of Car Construction, Inspection and Test Methods, and a long list of other pertinent subjects.

The automotive industry was also quick to appreciate the need and value of standards and today the standard handbook of the Society of Automotive Engineers is used by nearly every draftsman and designer in the industry.

Results of Application to Motor Boat Industry

The motor boat industry has been directing its efforts for some time past toward producing standard boats in large quantities. It is now possible for dealers, and others, in almost any part of the world to secure reliable, well-built, runabouts, cruisers, fishing and work boats, dories and house boats in any desired number, with a wide range of sizes and power plants, at attractive prices and without delay in delivery.

By standardizing its product and the components thereof, the industry has simplified the buying of spare parts and also the installation of different engines in the same size and type of hull. Not only that, but further study is being given to the interchangeability of marine hardware.

Possibilities with Larger Vessels

Is it not logical to assume that there exists similar opportunity for the application of simplified practice in the design, construction and maintenance of the larger vessels? In our correspondence with several of the groups here represented, we have received suggestions on the possibilities of greater standardization in—pipe and valve sizes, fire and deck hose, grate bars, ash ejector pipes, pistons for auxiliaries, stuffing boxes, propellers, anchor chains and dynamo brushes. Each of these items suggests a survey to determine the most commonly used types and sizes thereof, and the elimination of unnecessary varieties.

There are, no doubt, many other items used in building and outfitting, in which the existing variety in size can be greatly reduced with advantage to all concerned.

However, simplified practice applies not only to the mechanical problems, but to the commercial problems as well. For example, there is a general movement among shippers and warehousemen to simplify current commercial practice through standardizing the forms and papers passing between them and the public. The possible economies and advantages of standardized ocean bills of lading have been frequently discussed in the marine trade papers, and it is very probable that their adoption as a simplified practice will lead to similar effort to refine other features of the clerical work involved in handling cargoes, with a resultant saving in operating costs.

The direct costs of loading and of discharging cargoes may be reduced through the standardization of equipment best suited for transferring goods. Savings made in that operation mean reduction of the delay in port, thereby increasing the "turn around" and consequently the earning capacity of the ship. Greater standardization of cargo handling gear means the advantages gained in transportation will not be lost in port.

Simplification an Aid to Foreign Trade

But aside from those direct economies that will come to the shipping industry, if it applies simplification, there is another attractive side to the subject and that is its value as a builder of foreign trade. Many of our manufacturers know that domestic industry has outgrown the domestic markets and that America must seek outlets for her surplus products in foreign countries.

At the recent convention of the American Bankers' Association its commerce and marine commission, in reporting its studies of the merchant marine situation, said:

> "It is well recognized that the United States has reached a point in its industrial and commercial development where increase in foreign trade is essential to the marketing of surplus agricultural products and manufactured goods. If producers were to depend altogether on domestic consumption, it is believed there would be a recurring demoralization of prices, due to over-production. To a considerable extent, therefore, a stabilized prosperity depends upon adequate transportation guaranteed against interruption by carriage under our own flag for the greater part thereof."

Meeting competition in transportation is mainly a matter of continuous reduction in the cost of moving a ton of freight a given number of miles. Eliminating waste through simplifying current practice will help greatly toward that end. Many of our manufacturers are meeting foreign competition by applying standardization and simplification, thereby lowering the cost and improving the qualities of the goods they ship overseas. Our Bureau of Foreign and Domestic Commerce foresees a gradual rebuilding of our export trade and is making every effort to bring the profits from it into every manufacturing center in our country. This cooperation of the Department with industry forecasts the time when there will be a far greater demand for ocean transportation than now exists. As a matter of preparedness against that time, it seems highly desirable that the economic advantages

of simplification to the entire shipping industry be studied and analyzed. Speaking of preparedness—the same committee of bankers, just referred to, further stated that following the disposal of the present government owned fleet, "steps should be taken leading to the building of those types of vessels which our merchant marine now lacks, and which should be built with a view to use as naval auxiliaries in case of war." Standardization should play an important part in any new construction, and now, when things are quiet, is the best time to decide what that part will be.

It savors of ancient history to talk much now about the Great War, but it is only good sense to apply the lessons we learned then to our plans for the future. Those of you, who aided in the hurried building of our ships then, know only too well that the lack of standardization was, at first, a *great obstacle* to rapid construction and a serious factor in the multiplication of costs. Later, it proved to be an essential element in winning the war.

It may interest you to know that the War Department is closely watching the present trend of simplification with regard to its importance in national preparedness. They see in it possibilities for quicker mobilization of requirements, through having available maximum quantities of standardized articles. Such articles, by reason of their relative ease of production, permit greater flexibility of supply, with a minimum disturbance of processes and a minimum displacement of labor.

Foreign Countries Applying Standardization

If there were no other reason for immediately attacking this problem, the activity of foreign countries is sufficient! Eleven European nations are applying standardization—so is Japan, and also Canada. The British are very active in its application to marine problems, the British Engineering Standards Association having published specifications for: Structural steel for shipbuilding; main and auxiliary boilers; steam feed pipes, cocks and valves; condenser tubes; shafting for marine engines; hinges and locks for ship's joinery work; table glass and crockery; oil lamps, and also vertical bollards, or bitts. That body is working on nearly forty other simplifications.

The *London Times* said in a recent editorial, "it seems certain that industrial supremacy in the future will depend very largely on the simplification of manufacturing processes to avoid waste."

Not long ago, the Norwegian Standards Association asked the American Engineering Standards Committee for a summary of the standards developed for American marine construction. Here in America, we ought to have some center of information that will keep us all fully informed on what the other nations are doing toward lessening construction, operation and maintenance costs. Secretary Hoover said recently that, if we are to maintain the industrial and commercial lead which standardization has given us over the other industrial countries, we must carry it much farther than we have.

We are told that American shipping cannot compete with foreign shipping, that certain legislation revision as well as certain financial assistance or cooperation is necessary. Granting the truth in those statements, neither of those measures in themselves will automatically produce lower costs, volume business and faster or better service—which in the last analysis form the real basis of competition in any form of commercial activity. And until every group or association concerned with our merchant marine problem is actively engaged in a united and concerted effort to improve the science and art of ocean transportation, through eliminating all avoidable wastes and simplifying current practice, the industry as a whole will not be living up to its true responsibility and obligation to the American people, from whom and to whom it is looking for support and cooperation! Standardization, simplification—call it what you will—is a potential economic force which we should put to work for us.

Standardization when brought about by producers or consumers alone may cause suspicion as to the motives but when all interested parties, including the Government, cooperate in the project, then there can be no such question. An opportunity for such cooperation is found in the Simplified Practice undertaking sponsored by our Secretary of Commerce.

How Simplified Practice Is Applied

When the principles of Simplified Practice are applied in any field, all interests—producing, distributing and consuming—agree to recognize certain dimensions and varieties, among the tremendous diversity produced, as a standard practice for the ensuing year, or other period, set to the agreement. The remaining sizes and varieties are eliminated by mutual consent as obsolete, unimportant or poor practice. Major production is thus directed to a temporarily standardized line, while the engineers, designers and inventors are left entirely free to develop all possible improvements. At the end of the period covered by the Simplified Practice Recommendation, the industry again convenes and makes such modification in the recognized varieties, as may be necessary to include advances in the art.

In Secretary Hoover's plan, the recommendations adopted are published by the Department of Commerce, which through its Division of Simplified Practice, accumulates data on the percentage of product made or consumed in accordance with these recommendations and on the special varieties which are found necessary. The Division thus gathers information for subsequent conferences, permitting intelligent modification of recommendations.

In certain fields, such as weights and measures, establishment of permanent and absolute standards is obviously not only warranted, but vitally necessary. In industrial and engineering fields, on the other hand, it seems probable that the elementary and flexible simplifications contemplated in the Hoover plan will prove a most valuable modification of the earlier standardization conceptions.

Suggestions Offered

If then you feel that there are some worthwhile gains to be made through this form of waste elimination, I would suggest.

1. That there be formed a Central Committee, or "American Marine Council," made up of representatives from every association or group interested in, or connected with, our merchant marine problem.

2. That this council, if you please, be given the responsibility for a comprehensive survey of the facts to determine:

(a) the prevalent wastes in current practice, both commercial and engineering, and

(b) the extent to which simplification and standardization may be practically applied throughout all phases of the industry, and

3. That a definite time be set for the completion of the survey, and for another general meeting to receive the report, and act on its recommendations.

When that time comes, we cordially invite you to hold the meeting at the Department of Commerce in Washington, and to make full use of our services in achieving your objects.

New Radojet Pump.—At the Marine Exposition the C. H. Wheeler Manufacturing Company, Philadelphia, Pa., exhibited a new Radojet pump showing combined inter and after condensers. Heretofore there has been a separate inter condenser condensing the exhaust steam from the first stage of the radojet and a second after condenser condensing the exhaust steam from the second stage of the radojet. These have now been combined into one unit.

Standardization as Affecting American Shipbuilding*

By E. H. Rigg†

During the last two decades there have been many converts to standardization; it has made stronger headway in fields other than shipbuilding, and there is almost no one today who will deny the value of the general principle. It is when you come to apply it to concrete cases that difficulties arise. Without standardization, shipbuilding, as we knew it during the war, would have been impossible; the question is therefore on the extent to which it shall be carried rather than on whether or not standardization shall be adopted.

IN shipbuilding standardization much has been done by such bodies as the Federal Bureau of Standards, the American Bureau of Shipping, the United States Steamboat Inspection Service, the American Society for Testing Materials, the American Engineering Standards Committee, also the Treasury and Navy Departments. The Navy Department is mentioned here last merely because this paper mainly deals with merchant shipping. On navy work, navy standards are naturally paramount, and their influence also extends into merchant work in yards doing both kinds. Owing to the service conditions under which warships operate, these standards are generally more exacting than those governing merchantmen.

Apart from the well-known and long-established classification societies, there is a relatively new body of this nature that bears on our business to a considerable extent, namely, the British Engineering Standards Association, whose work in standardizing specifications for structural materials, products and fittings entering into ship construction is decidedly more far reaching than anything we have; however, as noted above, we are by no means without similar bodies.

Standardization is a large subject. The deeper one gets into it the larger the possibilities, and, as would be expected, the more impressive the difficulties.

A paper on this subject read before the North East Coast Institution of Engineers and Shipbuilders by Mr. C. leMaistre, secretary of the British Engineering Standards Association, in March of this year, is both interesting and informative. One among many interesting points brought out is to the effect that standardization has reduced steel costs of production by at least 5 shillings (nominally $1.25) per ton; such points effectually nailed down as proven will do more than many sermons to convert the skeptical. A study of this paper will well repay those interested and will also show the standing which standardization has already attained in shipbuilding abroad.

An extremely interesting test of the value placed on standards is to ask one of our yards to build a vessel using Whitworth standard screw threads throughout. It looks fairly innocent at first, but wait till you begin writing to the makers of the auxiliary machinery, to say nothing of your own machine shop's feelings in the matter!

Standard Ships

Taking standardized ships first, as distinguished from variegated ships built from standard parts: during the war we built many such standard ships; the Hog Island, Submarine Boat Corporation and Great Lakes numbers and types of standard cargo vessels stand out pre-eminently as the biggest efforts along those lines. There were also other standard cargo types, but these were built in fewer numbers. The vast numbers of submarine chasers are another instance, also the large number of destroyers built for the Navy.

The cargo vessels above referred to were laid down to meet a war need, it is true, but they remain distinct from the strictly naval vessels. As one effective answer to the submarine campaign of the enemy, they, without doubt, fulfilled their object. The 7,825-ton Hog Island boats are a more generally useful type than the Submarine Boat 5,075-tonners or the Great Lakes 4,200-ton steamers, useful as these smaller vessels are in such localities as the Baltic and on the short-run trades.

That we shall again witness such an effort is not probable; further, that this effort has helped to put a quietus on general cargo vessel construction for some time ahead is also to be admitted. As an example of standardized work which justified its conceivers, there is no doubt that it did more than make good; while there were differences in detail in these groups, such minor variations did not alter the status of the ships as standardized products. These detailed differences sometimes indicated progress, but were in many cases unjustifiable and extremely annoying to the builders; they serve to emphasize one of the main arguments against standardization, namely, that it prevents progress. Automobiles are standardized, but that does not prevent improvements being made in the 1922 over the 1921 model. In the same way, succeeding ships for a particular trade can and do embody improvements over the earlier ones.

The situation for standard ships would appear to be as follows: In emergency, when large numbers of ships are wanted in a hurry, by all means build to a standardized design. When all are building in one yard this holds absolutely; when building in several yards it holds in general, with the qualification that each yard should be allowed to adhere to its own general way of doing business and to work to the same general plans and specifications in its own way, with freedom as to details. This can be qualified to say that full consideration should be given to a yard having plans, etc., available for a vessel substantially equivalent to the proposed standard ship.

Main and auxiliary machinery should be common to all ships of the type and therefore interchangeable from ship to ship to a very large extent; this has helped deliveries frequently when a broken part in an earlier ship can be taken from a later vessel.

As a normal proposition, wholesale standardization of complete ships is not to be looked for. It cannot be denied, however, that there are so many tramps of certain deadweights as to very closely approximate standardization. The large class of 7,000 to 8,000 tonners is worth noting, even though we have variety in detail to suit different builders' and owners' ideas.

When repeat orders are given for a vessel already built, the work is thus partly standardized. There are many instances of this on record; a type proves satisfactory in service and may be repeated at intervals in groups as many as fifteen or twenty times, with only minor and detail changes. The work is thus spread over a period of years, so that the advantages due to repetition work in the shops do not enter into the consideration. The main advantage is in time,

*Paper read before the Society of Naval Architects and Marine Engineers, New York, November 9, 1922.

†Naval architect, New York Shipbuilding Corporation, Camden, N. J.; member of Council, Society of Naval Architects and Marine Engineers.

because the design, plans, material-orders and specifications are immediately available.

Oil and cargo ships come in the repeat-order category rather than passenger ships. The Shipping Board 535-foot passenger ships were an example of a large number of ships laid down to the same original plans as troopships, but finished up in groups for several lines and services as passenger ships. The hulls were practically identical, but even here changes were made to get different oil-fuel capacities; the machinery was built in groups to spread the work to different boiler, turbine and gear plants, so there was only partial standardization in machinery. The passenger accommodations were most wide of "sameness." While it is misleading to say that no two ships were alike, it is fair to say that with sameness of outline plans we have very considerable differences in detailed arrangements and decorative schemes, so that these differences finally resulted in a fleet wherein there were greater or lesser differences in every ship. Arguing from this and from general experience, standardization of passenger ships may be dismissed from serious consideration, except in quite small groups. Shipbuilding, in the nature of things, does not lend itself to standardization as a whole, but to build large ships in groups of limited numbers, suitable to particular trades, is a practice as old and older than anyone living today.

There is a large field where more has been accomplished than meets the eye on first approaching the subject, namely, international agreements on such matters as rules for avoiding collisions; signal codes; tonnage laws; lifeboats, and subdivision of passenger ships. Working agreements between classification societies in different countries tend toward broad-gage standardization. Standard loadline regulations are well on the way to international scope. Agreement to recognize each other's inspection certificates covering passenger and crew accommodations between countries having substantially the same regulations is another step towards the common goal.

The tendency toward international codes covering the fundamentals of shipping both as to building and to operating is right and proper, particularly when it is remembered that the high seas are world wide and provide highways common to all nations. The sea does not ask if a ship be American or French, but treats them all alike; hence the growing volume of international standardization of fundamentals is to be welcomed and helped as a means of getting along better with international intercourse and trade.

Standardization of Materials

Turning to the standardization of parts entering into ship construction, we find much to study. We also find great progress to record. We even find some progress towards international standardization, though this phase of the problem has naturally not progressed nearly as far as international covenants covering broad principles.

Consider the steel of which ships are nowadays constructed. Wood, iron and concrete need not be considered here, because merchant shipping today is, to all practical intents and purposes, universally constructed of steel or steel products.

International specifications for ship steel have not yet arrived in spite of efforts which were under way when the war broke; the difficulties are great, and they begin in the mines where different ores have different characteristics and properties. A universal specification is difficult to draw that would avoid undue favor to some mills as compared with others. American, British and German steels have their own characteristics, but given a willingness to cooperate, it should not be impracticable to draw specifications broad enough to cover a merchantable article satisfactory for use the world over. One great question is: Can genuine willingness to agree, if possible, be obtained? Without at least that as a basis, it is no use trying for international steel standards.

During the war, considerable progress was made towards international standard rolled sections, such as angles, channels and bulbs; this as between America and Britain. Here we have two standards, structural shapes and ship shapes, these ship shapes being identical with the British except in minor points; there they have one set of standards for bridges, buildings and ships. There is considerable opinion in favor of a single standard here. The manufacturers fear scrapping of equipment before it is worn out; the answer is that properly regulated standardization is not an over-night affair and will involve no scrapping of good equipment. France has been on a metric basis of measurement almost as long as the memory of man runneth, but I am told that even yet in the remote rural districts the old non-metric units are largely used in local trading.

The inch, pound and metric units involve us in trouble when considering international standards. The obvious way to get around it is by printing two columns parallel to each other; customers in metric countries can use the one in which they can think best. The metric system, or lack of it, is no bar to international standards, though it is an admitted difficulty, which benefits the printing trade more than anyone else.

Since the war, progress towards international rolled steel standards is to be noted on the part of Australia, Belgium, and France, as well as between ourselves and Britain. Plain angles present few difficulties; the channels, bulbs, and I-sections are the crux of the matter. Standardization of what we may term secondary ship materials such as brass, bronze, iron and wood is also to be kept in mind.

Again a real question is: How willing are the different parties to go at the matter and find a solution that will give the best sections designable and commercially manufacturable at this date? Without this willingness, we are merely beating the air.

The war has done at least one good thing: It has taught us that undertakings before considered impossible can be put through provided the will to accomplish is there; that men and women of many races can forget petty differences and work together for a common goal. Whether broad-gage sentiments similar to those inspired by the stress of war can also be invoked for peace-time objects is at least open to debate, especially in the present condition of world affairs.

Again, do the foreign trade elements of each nation want uniformity in these matters, or do they want the Tower of Babel?

The transition stage would have its troubles; the present state has its disadvantages. The same solution for steel specifications, both as to composition and dimensions, as has already been applied to such matters as tonnage, safety regulations, etc., would appear to the writer as the proper one, namely, broad-gage standardization on an international basis with equitable leeway to each nation as far as individual peculiarities are concerned, such as extend from mine to finished product.

In developing new countries, is it an advantage or a disadvantage to have similar structures and equipment built to varying specifications, and to whom do the advantages and disadvantages accrue respectively?

It is to be noted that the Department of Commerce, under Mr. Hoover's leadership, is endeavoring to eliminate waste and reduce costs and so to extend the benefits resulting from simplified practices in industry. The machinery that it is proposed to set up will be representative of all interests concerned and will have safeguards to prevent rejection of newer and better ideas as they come along.

Mr. Hoover uses the word "simplification," which is not the same as "standardization," though in many respects the two will be hard to separate. It is well to bear in mind the

differences between the two words; their meanings and applications will converge and diverge as we study our subject in all its ramifications.

The procedure suggested by Mr. Hoover is very much that of the American Society for Testing Materials, where producers and consumers sit down together and agree to agree or disagree on standard specifications for the major materials and their subdivisions.

A study of Mr. leMaistre's paper referred to above will throw an interesting light on what is being done along the lines of standardization and simplification in British shipbuilding and other industries.

A study of the pocket books issued by the different steel manufacturers will impress one with the vast number of special shapes to which steel is rolled; that a gradual reduction in number of special shapes would benefit everyone concerned will hardly be disputed. As existing commercial equipment wears out this becomes at least possible.

Standardized Methods

Regarding standardized methods of production, shipyards are organizations subdivided into many departments or trades. They are not unaware of what is going on in the general industrial world in the way of advanced methods. There are at least two good reasons why the practices of factories, pure and simple, cannot be fully applied; one is the diversity of product as between ship and ship, and the other is diversity of parts entering in to any one ship.

What all efficient yards are doing, particularly since the present depression set in, is to so organize their methods as to adopt for each shop the best that can be worked in. We all have certain routine ways of doing things. In a poor plant the routine runs the plant for a certain or uncertain season; in a good plant the routine is modified and improved conservatively and constantly in such a way as to cut down work, save time and labor, eliminate duplication, and also secure harmony and effective intermeshing of departments.

Too much departmentalization will kill any shipyard. You all know the small-minded departmentalist who cares not what happens to the department on each side of him, just so long as his particular department makes a good showing.

Modern established yards have their own standard ways of handling work; from design to delivery, standard forms and methods are used. These should only be changed conservatively, and after the management is sure that they have all the cards on the table; a change made to suit one noisy departmentalist will almost surely bring trouble and can very easily change a profit into a loss on the completed ship. We also have standard specifications. For yards handling more or less one line of work, this is undoubtedly correct; for yards with a diversified product it is still correct, but cannot be made to work without greater labor in adjustment to particular cases. These specifications should follow in arrangement the yard charge and plan numbering system, so that an index is unnecessary to one familiar with the system, thus saving more time for more people than will be realized. The index should be there for convenience of owners and others not acquainted with the system.

It seems hardly necessary to say that all forms and drawings should be uniform, also all calculations, material-orders and correspondence methods. The responsibilities and limitations of each department should be clearly defined and no point left in the air to fall hapless between two or more parties.

Standard Details and Fittings

We now come to standard details. Each established yard now has its own standards and each owner has his own particular requirements. Each yard wants to use its own standards, which works for a cheaper ship.

The British have decided that there is no good reason why a lot of fittings and equipment cannot be nationally standardized and, having decided so, they are doing it. There is a host of fittings that lend themselves to this treatment, such as manholes, airports, doors, davits, boats, bitts, cleats, chocks, sanitary fittings, winches, windlasses, anchors, chains, steering gears, etc., down to minor fittings such as cups and saucers. Providing the standards are of a good quality and agreed upon by the jointly interested parties, why not eliminate as much special work as we can? This British experiment is well worth noting as we press on our way to the building of ships economically.

With standardized fittings it is easy to see both time and money saved; stocks can be kept fuller without fear of loss.

Standard Machinery

With reference to machinery, we have just arrived at standard specifications for moderate-powered, reciprocating-engined, Scotch-boilered cargo boats. We arrived there, however, in the midst of the modern upheaval in methods of propulsion; the claims of Diesel drives, Diesel-electric drives; electric, hydraulic or mechanical reduction-gear drives, direct-turbine drives, watertube boilers versus cylindrical, also last, but scarcely least, the war.

The standard specifications here referred to are those prepared in Britain with a view to harmonizing classification and governmental requirements for main engines and boilers and giving to builders one set of rules and specifications to work to. What success has attended their practical working is not known to the writer.

The reconciling of classification and governmental requirements where these overlap is something which will save time and money; the application of two or three formulæ to figure out the same dimension involves duplication of effort and, consequently, waste.

Motors for ship propulsion are a modern development. We already find elaborate standardization here for several reasons; with uniform power per cylinder, engines of four, six or eight cylinders are built. Oil engines are complex affairs at the best; the more parts to a given design the lower the already high cost per unit of power can be kept. Further, their manufacture commenced at a period when the benefits of standardization were already realized.

Electricity plays an increasingly important part in the auxiliary installations aboard ships. This industry is already highly standardized. The requirements of land and sea services should be brought as nearly to a common basis as is practicable.

Repairs and Upkeep

The importance of quick turn around in ports needs no emphasis before this body. The advantage of standardization in giving owners and repair plants a reasonably generous stock of spares to draw upon is obvious. With greater standardization in building, especially in machinery, we automatically get advantages in the matter of prompt availability of parts for repairs and renewals, the economy of which speaks for itself. The more general the standards, the fewer and less expensive the spare parts each individual ship will need on board. Certain parts liable to be needed at sea will always have to be carried, but stocks at terminals can be kept lower without danger of delay to the ship.

Standardization is a natural and inevitable corollary of modern industrialism; mechanisms are both more elaborate and more generally used than formerly. A plant in Chicago manufacturing and selling any one or more of many well-known modern mechanisms must consider the ability of its distant customer to keep the machine in condition. What ultimate good is a typewriter, for example which the owner cannot keep in repair; the "throw it away and buy a new one" answer is that of the reckless cub salesman, except after

the machine is worn out or genuinely obsolete. The only proper answer is standardization of machine and of such spares as are most liable to be needed, backed up by the most efficient distributing agencies available.

Uniform Requirements

The codification of governmental requirements for merchant vessels under one set of regulations should be aimed at; at present these are scattered and come under different departments for enforcement.

The reconciliation of the requirements of two or more bodies with concurrent jurisdiction is very important. The most outstanding case is perhaps that of boilers, the United States Steamboat Inspection Service and the classification societies each having their own formulæ. The success which has attended the adoption of the A. S. M. E. Boiler Code for land work needs no emphasis.

That the practical benefits of uniform requirements on an international basis are not lost to sight is evidenced by the recent reports of the committees appointed by the International Shipping Conference last November. These reports mark a step towards agreement on four important questions connected with shipbuilding, namely, life-saving appliances, wireless telegraphy, loadline, and passenger ship subdivision. The absence of United States representatives on these committees is to be noted, the writer feels, with regret.

Uniform standards of strength for ocean-going vessels may well be considered; the proposed international loadline regulations give us a basis. The various classification societies each have their own; in practice they are fairly close to uniformity. The extent to which their rules could with advantage be standardized might well form a subject for future discussion.

Summary

History has shown conclusively that standardization has already greatly benefited mankind; imagine the chaos if each mechanic cut screw threads to suit his own ideas, as was done in the early days. The whole point is that of arriving at well-balanced decisions on how far to go. Excessive standardization makes for lack of progress, while too little tends to restrict production. The right amount means the maximum of comfort and pleasure in life for the minimum cost, *i. e.*, the greatest good for the greatest number. The Ford car, Singer sewing machine and Remington typewriter are good examples.

The same general principles can be applied to shipbuilding, particularly in countries where the volume of business is so proportioned to the number of plants that each can specialize along certain definite lines. There are different designs of cars, sewing machines and typewriters, each made by the same plant but for different purposes, so that even where standardization is most developed we do not find absolute uniformity.

Portugal to Have Bargaining Tariff

By a decree of August 25, promulgated August 23, the Portuguese Government, according to advices received by the Department of Commerce, is authorized to introduce and bring into force immediately a new customs tariff, revising the rates of the double scale of maximum and minimum duties which have been in effect since November 24, 1921. This decree gives effect to the bill for this purpose introduced last May.

The projected tariff is to be revised again in 1923 and then adjusted to current conditions every five years. The basic rates may, however, be modified by the Minister of Finance, on the recommendation of the Council of Experts for the Customs Service. The government is authorized to conclude reciprocal commercial agreements with foreign countries in which the "minimum" tariff is to mark the limit of concessions on the part of Portugal. Such agreements are to remain in force not over one year.

Of particular importance to American exporters is the provision that during a period of six months from the date of publication of the new tariff any complaints may be presented to the Council of Experts for the Customs Service. After investigation of the complaints, the Council of Experts is to present their opinion to the government, which is authorized to make such necessary corrections in the tariff as seem advisable.

White Star Liner Majestic, the Largest Steamship in the World, Entering the Largest Dry Dock in the World, the Commonwealth Dry Dock in Boston Harbor

Recent Developments in Marine Insurance

Shipping Board Ratings Completed—Casualty Returns—Unrepaired Partial Losses—"Certificate" Vindicated—Better Hull Rates Wanted

By "Bordereaux"

FINAL recommendations of the various sub-committees of underwriters with respect to the rating of Shipping Board vessels for cargo purposes have all been turned into the central committee and the consolidated report has been transmitted to the Washington authorities. Liner ratings have been granted to a number of operators in particular trades, and "approved steamer ratings" have been given all of the old established operators. Uniformity has been arranged for as between different trades in which substantially the same basic conditions prevail between tonnage and other operating details of Shipping Board and competing lines.

The recommendations are made on the condition that they shall remain in force only so long as the vessels operated by the several Shipping Board agents are maintained in a condition of upkeep which meets with the approval of the United States Salvage Association, and are not loaded beyond their assigned marks. The Shipping Board has agreed to this.

For the information of the underwriters, arrangements have been made with the Salvage Association to issue periodical bulletins advising the names of the ships in the hands of the various operators which may be approved by it for the classification herein provided. Notice of the withdrawal of such approval, and also of any instances of overloading, will be promptly sent out to the underwriters.

The Conference Committee of the underwriters expresses the earnest hope that the various cargo insurers will recognize the improved conditions by adopting the recommendations. In this connection attention is called by the committee to the effort of the present managers of the Fleet Corporation to increase the efficiency of their operating agents and to promptly meet the reasonable requirements of the United States Salvage Association, of which ample evidence has already been had, and also because of their promise to extend to cargo claims consideration equally prompt and equitable with that executed by their privately owned and operated competitors.

Marine Casualty Returns

THE Liverpool Underwriters' Association has issued a classified return of casualties to vessels of 500 tons gross register and upwards, which have been posted in the loss book during the month ended September 30, 1922. Taking into account both British and foreign vessels, steam and sail, it shows the following record: Weather damage, partial losses, 28. Founderings and abandonments, total losses, 3. Strandings, total losses, 6; partial losses, 127; total, 133. Collisions, total losses, 3; partial losses, 143; total, 146. Fires and explosions, total losses, 1; partial losses, 57; total, 58. Missing, 1. Damage to machinery, shafts and propellers, partial losses, 75; other casualties, 12; total, 87.

The number and total gross tonnage of vessels lost, posted in the loss book during the month of September, 1922, were as follows: British, sail, none; steam, 3; gross tonnage, 5,898. American, sail, none; steam, 1; gross tonnage, 691. Japanese, sail, none; steam, 1; gross tonnage, 989. Rest of the world, sail, 2; gross tonnage, 2,721; steam, 7; gross tonnage, 18,701. For September, 1921, the total of gross tonnage casualties in the entire world was 29,789; for September, 1920, the same item was 32,338.

How Unrepaired Partial Losses Work Out

IF an unrepaired partial loss on a hull is followed by a total loss during the currency of the policy it cannot be collected from the underwriters. And yet, if, at the expiration of the policy, repairs have not been made, the underwriter is obliged to pay for the same, even though a total loss occur under the subsequent policy before repairs have been made. The logic behind this rule rests on the ground that the valuation under the renewal policy would not be as high as under the first policy, due to the unrepaired condition of the ship; that is to say, the subsequent total loss payment would be reduced to the extent of the unrepaired damage. By this reasoning there are instances where the owner is able to recover more than the value of the vessel, because frequently the renewal policy is placed some time previous to the expiration of the first policy and while the vessel is still in sound condition. After placing the renewal policy on the same valuation as the original policy, and before the expiration of the first policy, should a loss occur which is not repaired before the attachment of the second policy, then the underwriter on the first policy must pay the estimated cost of repairs. If a total loss then occurs under the second policy before repairs are made, the shipowner will have recovered more than the amount of the insured value of the vessel.

Displacement Invention

A DEVICE has been invented by a French ship engineer, according to a report recently received from Consul Wesley Frost, of Marseilles, France, by which the amount of water displaced by a vessel can be ascertained at any given time. It consists of a water tube or gage installed in the center of a ship. It is very simple in construction and can be installed at a minimum of expense. Underwriters are interested in the invention, because of the opportunity it affords for securing at any time an accurate indication of the weight of the cargo aboard.

"Metal Mike"

INSURANCE men are always alert to measure the advantages to be derived from new inventions that may have a bearing upon the safety of ship and cargo. Their attention has been called to the satisfactory working of a mechanical device, popularly dubbed "Metal Mike," that, it is claimed, will hold a ship to her course at sea without the aid of a quartermaster. Should the vessel deviate from the set way, warning is given by the automatic ringing of a bell. This interesting steering apparatus is not employed in entering harbors. It was first used experimentally on a German steamer in 1915, but never on an American ship until a week or so ago.

New Tariff on Ship Repairs

THERE is a feature in the new tariff that gives promise of concealing a vigorous back-fire for marine underwriters. That is the ad valorem tax of 50 percent on the cost of repairs to vessels of American registry when effected abroad, unless caused by stress of weather. Prominent insurance men pronounce it "outrageous," and see in it a serious handicap to the extension of our merchant marine. The penalty for non-disclosure is the confiscation of the vessel. The question arises whether, in event of a claim for repairs on which the tax is collectible, the underwriters can be required to pay the tax. This feature of the new law means that American vessels will have to be repaired in American shipyards where, it is generally believed, costs are considerably higher than those charged by European or British repairers. It would seem that the new tax prohibits the effecting of repairs, to any great extent, abroad, thus imposing a burden of 50 percent additional upon American ships.

Extra Charge for Buffalo Lay-ups

IN consequence of the slowness of the Government in making necessary repairs to the breakwater at Buffalo underwriters are imposing an additional premium of three-quarters of one percent on boats laying-up at that port through the present winter. The regular lay-up charge is twenty-five cents; which means that the additional cost will bring the premium up to one percent. Lake hull underwriters held a special meeting at New York a few days ago for the purpose of discussing the situation, and a representative was sent to Buffalo to study conditions there and report back to the underwriters. The result has been a serious discountenancing of using Buffalo for laying-up ships under prevailing circumstances.

London Reduces Tank Steamer Rates

A BIG break in tank steamer rates is reported from England. Underwriters complain of a slender margin of profit at the old rate of 4½ percent, and they fear the worst now that tankers are being freely covered at 3½ percent. A large portion of the orders of this kind come from America, where some of the largest fleets are owned. On these the all-risks rate of 4 percent has been for American coastwise trade, with an additional premium of one percent for Institute warranties. These risks are now being placed at a flat rate of 3½ percent, with an additional ½ percent for Institute warranties. This brings the rate, with full transatlantic privilege, to a point one percent less than it was a year ago.

The "Certificate" Vindicated

THERE is great satisfaction among insurers over the recent decision of Mr. Justice Sankey, of the King's Bench Division of the English court, to the effect that a marine insurance certificate is a valid tender when substituted for the original policy. Our readers will recall the mild consternation with which American underwriters received, a year ago, the decision of Mr. Justice McCardie, also of the King's Bench, in which he ruled against the substitution of a certificate for a policy. That judgment has had little effect upon the continued use of the ever-popular, time-saving certificate, but occasionally a bank or ultra-cautious shipper would complain that he did not feel secure in the face of the finding of the British court. Now comes Mr. Justice Sankey, of equal rank with Mr. Justice McCardie, and sustains the certificate. His judgment was given in a suit brought by Donald H. Scott v. Barclay's Bank, Ltd., and the full text may be found on pages 502-506, Part No. 7, Vol. 12. of Lloyd's List Law Reports. The language of the judgment reads as follows: "I find that the certificate was a policy within the definition I have given to which no reasonable mercantile objection could be made on the point of it being a certificate as distinguished from a policy."

The suit also developed an objection to the certificate on the ground that it was a "dollar" insurance against a sterling letter of credit; but this was also brushed aside by the Justice as being without merit.

Bureau of Shipping's Slate

A COMPLETE slate for its board of managers has been placed in nomination by the American Bureau of Shipping for election at the meeting of January 31. All are up for re-election with the exception of George J. Baldwin, of the American International Corporation, who wishes to retire, and in whose place appears the name of Asa F. Davison, general manager of the United Fruit Company. There is to be an addition to the regular list in the presentation of the name of H. A. Magoun, vice-president of the New York Shipbuilding Company. The Board, as nominated, is as follows: John S. Ashley, Louis F. Burke, H. L. Coulby, William J. Davidson, Asa F. Davison, William A. Dobson, Homer L. Ferguson, Richard D. Gatewood, Edward C. Gillette, William R. Hedge, William H. McGee, Samuel D. McComb, Frank Gair Macomber, Charles E. Mather, H. A. Magoun, Frank C. Munson, Charles R. Page, Walter Wood Parsons, Antonio C. Pessano, Joseph W. Powell, H. H. Raymond, John C. Rohlfs, Benjamin Rush, Alfred Gilbert Smith and Joseph J. Tynan. Douglas F. Cox, of Appleton & Cox, and A. F. Davison, of the United Fruit Company, were added to the list of members. It is proposed hereafter to have special sub-committees of the Technical Committee on Naval Architecture and that on Marine Engineering appointed.

Deposits and Forced Sales

THERE is current among underwriters an increasing dissatisfaction with what they regard as flagrant culpability on the part of many shipowners in transfering to their own funds general average deposits and monies realized from the sale of damaged cargoes. The proper custodians for such funds are the regularly selected trustees. Furthermore, it is felt that there is too much delay in distributing the proceeds of cargo sales, resulting in serious disputes with respect to interest due the owners of the money. The evident disposition is to enforce these objections upon shipowners with considerably more firmness than has been the custom of recent years.

Better Hull Rates Wanted

ONCE again the season for the renewal of hull rates has rolled around and with it comes a determination on the part of underwriters to have more rate. It is pointed out that values have continued to decline and that there is no immediate prospect of their attaining a higher figure. Added to this is the meager reduction in the cost of repairs, by no means proportionate with the fall in values. These two elements enter vitally in underwriting calculations as respects particular average costs. They bring the premium volume down and, at the same time, compel the insurers to make disproportionate expenditures out of a decreased income. The difficulty is increased because such a situation invites an abnormal volume of particular average claims. The market would have a better chance to right itself, if it were less extensive than it is at the present time. With so

many companies writing insurance there is too much competition, the result being that all sizes of hull lines are absorbed with ease. Brokers find no difficulty in placing even undesirable hulls, and they can secure rates that practically preclude hope of even the narrowest margin of profit to the underwriter. Violent competition has already sent tanker rates still further down, and the prospect is that the end is not yet in sight.

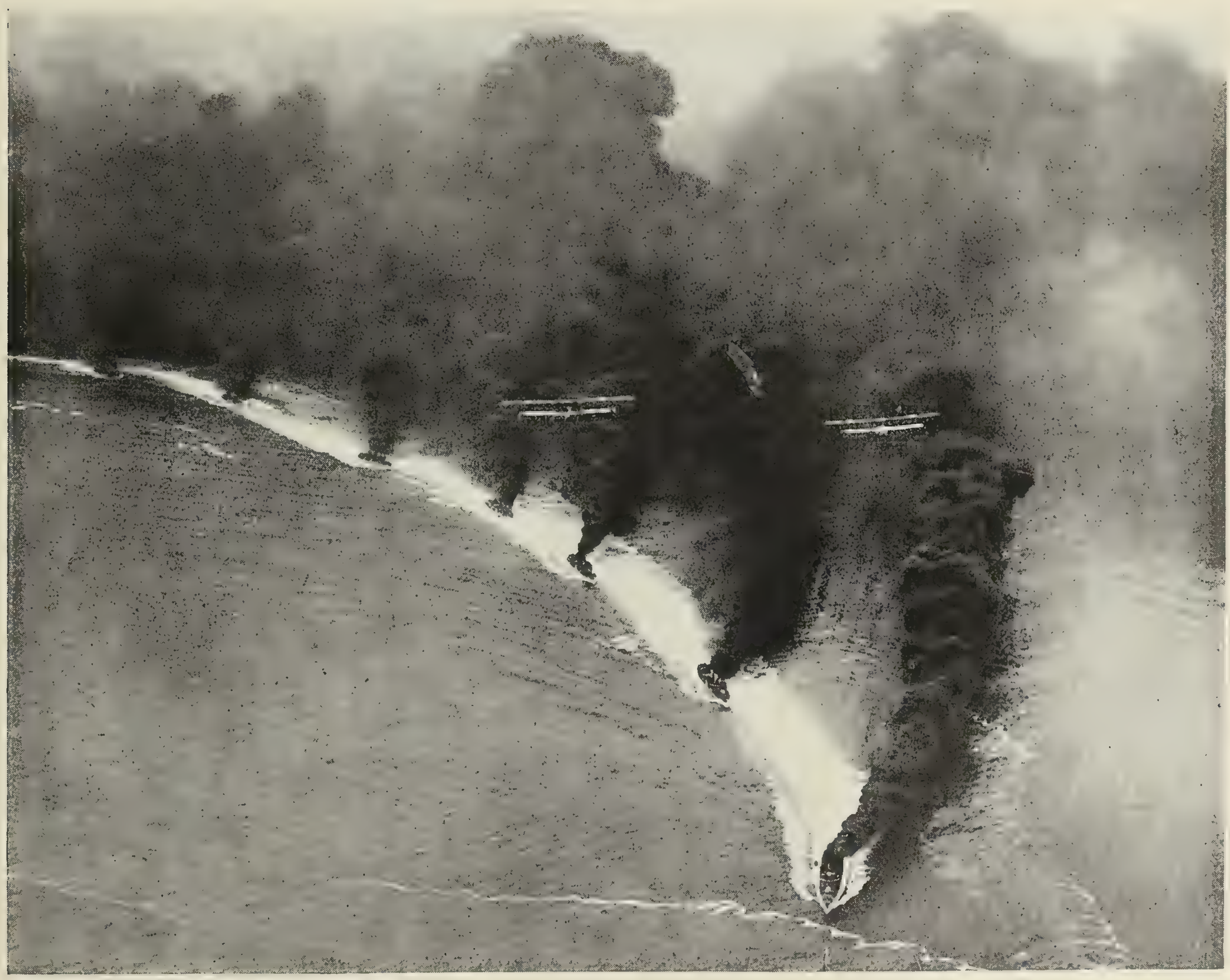
Co-operation in Lay-up Returns

AFTER more or less discussion Lloyds and company underwriters in London have reached a co-operative arrangement by which claims for returns on account of vessels laid up idle in port shall be submitted to a central examination. A joint committee is to sit daily at the Institute of London Underwriters and claims of this character are to be laid before it for consideration. Upon the approval of such claims by the committee all the underwriters concerned are to settle at once without going any further into details. It is confidently felt that such an arrangement will prove advantageous to both brokers and underwriters, in that it will economize time and introduce uniformity in method.

Unit Type Packing Adapted to Marine Engine and Valve Service

A UNIVERSAL unit type packing, composed chiefly of shredded asbestos, graphite and finely divided anti-friction metal, is being marketed by Metalastic, Inc., 280 Broadway, New York. It is claimed that this packing is suitable for every type of stuffing box and valve in the engine room since it is in shredded form and takes the shape of the box or valve in which it is placed. Its composition is such that it will resist acids, ammonia, carbon dioxide, brine, etc., and has withstood pressures up to 8,800 pounds per square inch without blowing out.

It is claimed that the universal feature eliminates maintaining a variety of packings for engine service. Metalastic is guaranteed to have features of self-lubrication and not to score rods. In this connection the company states that it has been used successfully in steam turbines running at 3,600 revolutions per minute under 185 pounds' steam pressure and at a temperature of 480 degrees F. for twenty months without re-packing. It is claimed that the packing never solidifies and can be removed at any time and used again.



©*Keystone View Company, Inc., of N. Y.*

Destroyer Maneuvers off San Diego, Cal.

View of destroyer maneuvers on the southern drill grounds of the Pacific fleet of the United States Navy, showing dense smoke screen raised by the destroyers into which the airplanes seek protection.

President Harding Expresses Warm Interest in American Marine Week

October 28, 1922.

My dear Secretary Denby:

I learned through Col. E. A. Simmons, president of the American Marine Association, that you are to address the banquet of the Society of Naval Architects and Marine Engineers in New York on November 9. It was with much regret that I was compelled to decline the invitation to be present at the same time, and I am now writing to ask you to express to the gathering my warm interest in the work of this organization and my conviction that it represents a most useful contribution to the development of American maritime interests. I am sure I do not need to add much to what I have said on other occasions concerning my profound interest in and concern for the future of the American merchant marine. Its development and continued usefulness will not fail to constitute a large contribution toward the broadest material prosperity and the truest security of our country. It is always a satisfaction to acknowledge the debt which is owing to such volunteer organizations as the American Marine Association for the efforts in behalf of this great cause.

Most sincerely yours,

(Signed) WARREN G. HARDING

October 25, 1922.

My Dear Mr. McFarland:

I regret exceedingly that it is not possible for me to be in attendance at the banquet of the Society of Naval Architects and Marine Engineers, which is to be held on the evening of November 9th, in connection with the program of observances of American Marine Week. With all my heart I wish I might be a participant on that occasion. No one purpose more enthusiastically enlists the attention of the present administration at Washington than that of turning our vast assets in ships into a live and efficient Merchant Marine. Every day adds to the conviction that the upbuilding of our Merchant Marine is of first importance in assuring our national defense and of incalculable importance in maintaining America's fitting place in the commerce of the world. It would be a pleasure to me to express some of my hopes to those who will be present at your annual banquet. Since I am unable to attend I will thank you to convey my very cordial greetings and to express the hope that American Marine Week and the notable meeting of your society will add to American conviction that we must establish and maintain this agency of transportation on the high seas if we are to maintain a position of becoming eminence in the world of trade.

Very truly yours,

(Signed) WARREN G. HARDING

Mr. Walter M. McFarland,
29 West 39th St., New York, N. Y.

"American Marine Week" and the Marine Exposition Arouse Popular Interest in Merchant Marine

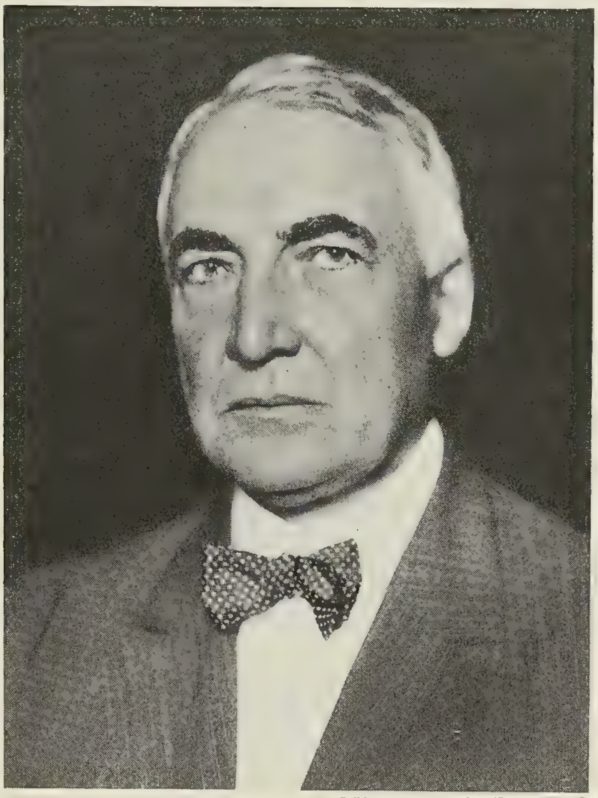
Secretary Denby Delivers Message from President Harding at Naval Architects' Annual Banquet Urging Support for Shipping

FROM the opening at eight o'clock Saturday evening, November 4, until the closing hour on the following Saturday evening, November 11, American Marine Week at the Grand Central Palace, New York City, was one continuous session of business, technical and social events. Practically every organization in the marine field was represented at at least one function and, from the President of the United States down to the men who man our ships, sincere and enthusiastic support was freely given.

The outstanding new feature of the week was the informal conference on "Standardization and Simplification," which was held in the Auditorium, Exposition Hall on Friday, November 10. About 100 delegates from maritime associations and societies, Government departments, and others interested in this subject from the shipbuilding, equipment manufacturing or ship operating companies were present.

Secretary Hoover Interested

Secretary Hoover is very much interested in the avoidance of waste in all industries and under this subject standardization and simplification play a most important part. The Secretary was unable to attend but was personally represented by Mr. R. M. Hudson, Division of Simplified Practice, Department of Commerce.



©Underwood & Underwood

President Warren G. Harding

In opening the conference Col. E. A. Simmons, president of the American Marine Association, explained the attitude of the Department of Commerce. The point of view of the Department is, according to the words of Mr. Hudson, that the one thing which must be avoided in the promulgation of this subject is any inference that the Government is trying to interfere or assume the direction of proceedings, a matter which is thoroughly one of self-determination for the industry. "We want to cooperate and gladly place all our facilities at the disposal of the group, if it desires to work out a program of simplification and standardization."

It is only fair to say, however, that the Department of Commerce has been of great assistance to the industries along these very same lines and has made it possible for them to secure beneficial results.

Object of Meeting

It is hoped in this country that we may accomplish what the British Engineering Standards Association has been working on for the last four years. This work was initiated in Great Britain in 1918 by the Board of Trade. Actual work was started in March, 1919, by the formation of two committees, one on ships' fittings and one on ship machinery details. During the meetings, which were held periodically, of the sub-committees formed covering the various sections or "panels" having to do with practices in defined districts, representatives from the Admiralty, the Board of Trade, Lloyd's Register of Shipping, the British Corporation, leading marine equipment companies and representatives from the foremost British shipping companies, assisted in the discussions.

Mr. Hudson's Paper

The paper read by Mr. R. M. Hudson at the meeting covers the objects to be realized and is published in full on page 746 of this issue.

The interest in standardization shown by all of those present was of a very practical nature. Every one expressed a complete willingness to cooperate in any way possible in the furtherance of this important undertaking. A motion was presented and passed that a committee of five or more individuals be appointed by the Chair to investigate ways and means for accomplishing the desired results of standardization.

The opinion was freely expressed after the meeting by prominent naval architects and other representatives that this was one of the most practical steps which has been undertaken in the marine field. With this in mind, the fullest co-operation may be expected from individuals throughout the shipping and shipbuilding industry. Mr. Carl E. Petersen, naval architect of the United States Lines, expressed the following comment:

> "The present period of depression is an opportune time in which to make a concerted effort to bring together the principals concerned and endeavor to establish shipbuilding standards; in a moderate way first, followed later on by a larger scale. The factors making for successful effort in this direction would include (a) full representation, (b) an agreement of the principals to abide by the findings, and (c) provision for modification of the standards when necessary in order to insure progressive standardization."

The Marine Exposition

As to the Exposition itself, the pictures of the booths illustrating this article speak for themselves. It was a great show, giving everyone an opportunity to inspect the products of all branches of the marine industry. Speaking of new devices and new products, this exposition easily led all previous events in both number and variety. It was difficult to cover them all in the November and December

issues of the magazines and in the Daily Bulletins that were issued during the week.

The best indication of the success of the show is that at this writing over 50 percent of the available main floor space for the 1923 Exposition has been definitely taken or requested. The membership of the American Marine Association, which has staged the Exposition for the last two years, is composed of the companies exhibiting and is strictly on a co-operative basis. Before the exhibitors got together and formed this association, outside parties had control and used the shipbuilders and manufacturers of those things with which ships are equipped as a vehicle through an exposition of this kind for making money for themselves.

The various marine organizations now realize that their own selfish interests demand a much greater participation in all that concerns the welfare of the American merchant marine. And it is also due to this realization that a far larger number of shipping and shipbuilding men attended this exposition than any previously held. The total attendance over and above the naval architects and marine engineers who were given special invitations amounted to 42,600.

Opening Night

The exposition was formally opened at eight o'clock November 4 by Col. E. A. Simmons, while at the same time the Commandant of the Brooklyn Navy Yard, Rear Admiral C. T. Vogelgesang, delivered an address which was broadcasted from the W. E. A. F. station. A concert was given by Todd Shipyards Corporation Marine Band.

Col. Simmons in referring to the last "American Marine Week" said in part:

"At that time the international conference on the reduction of naval armaments was in session in Washington. To our minds the result of that conference showed the necessity for still greater activity inasmuch as it was clear that our national safety would demand an increase in activity in the merchant field at least equal to the forced drop in the operations of our Navy. We are still of that opinion; and that fact, plus the commercial aspect, has stimulated our efforts, resulting in this great Exposition and the events of the coming week. Is it not significant that substantially every organization in the marine field is now co-operating with the American Marine Association that no stone may be left unturned to make the gravity of the situation known to every citizen in the hope that the nation will awake before it is too late."

"We must keep our Navy up to the highest standard of efficiency and we must buttress it with a merchane marine," declared Rear Admiral Vogelgesang in his address over the radio. "To deny a subvention that will give our merchant marine an equal chance with that of other nations is to stultify the development of one of the greatest factors that will govern our future prosperity economically, and our future national security."

Navy Night

Navy Night was fittingly observed on Monday evening, November 6. A large number of naval men were present, including Admiral Vogelgesang, commandant of the Brooklyn Navy Yard, his staff and many other officers. Just before Captain R. D. White mounted the platform to address the Exposition, the country's flag and the Admiral's ensign were broken out while the Brooklyn Navy Yard Band played the "Star Spangled Banner."

©Harris & Ewing

Herbert Hoover, Secretary of Commerce

©Harris & Ewing

Albert D. Lasker, Chairman, United States Shipping Board

©Harris & Ewing

Edwin Denby, Secretary, United States Navy

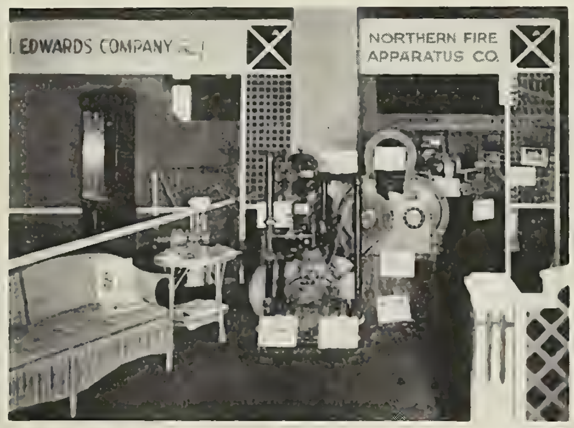
Captain White delivered a very stirring speech, appealing for an adequate merchant marine to go hand in hand with an adequate Navy. Referring to the merchant marine, Captain White said in part:

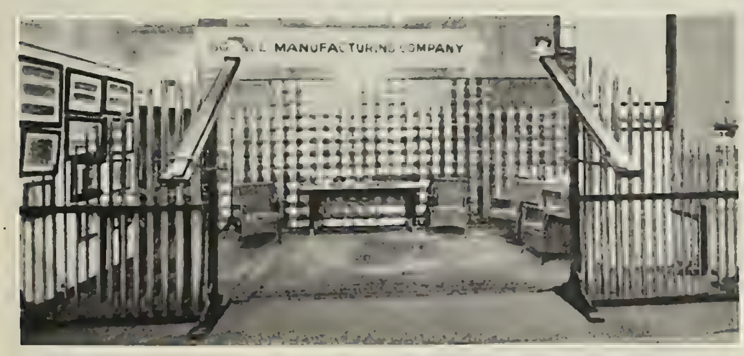
"It is only in recent years that far-sighted businessmen in the United States have begun to turn their eyes abroad for opportunities to invest their money and apply their talents. Now, the richest opportunity that appeals most to American imagination is the wealth that lies in the seagoing carrying trade.

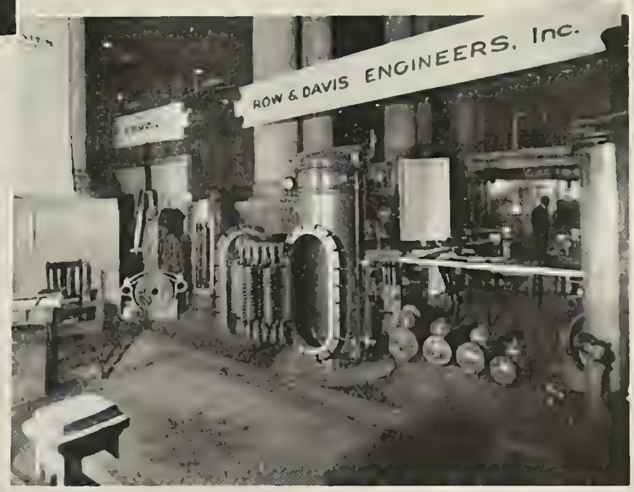
"We are late in seeing this opportunity but see it we must, for that is the vital problem facing us at the present time. It is only fair that we should carry, and profit thereby, our just proportion of our own commerce.

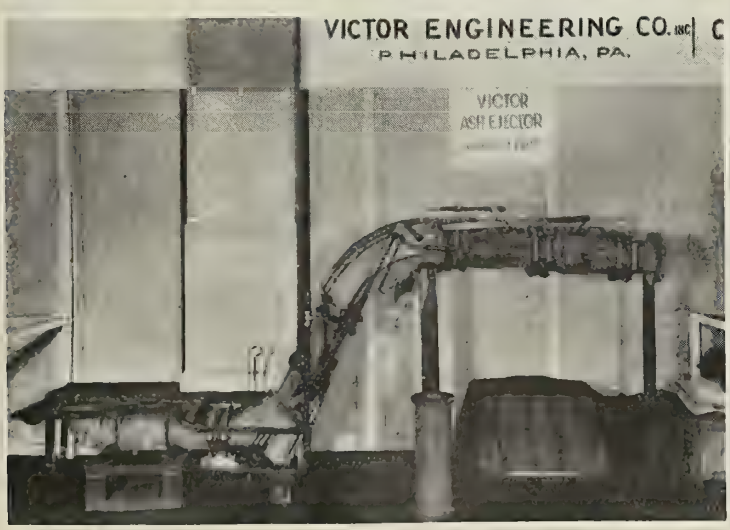
"Many obstacles beset our accomplishment of this end. These are too well known to shipping men and, for that matter, to the American public for me to enumerate them here, only permit me to say that the rum question is one of the least.

"But there is one to which I cannot fail to call your attention without failing in a duty I owe to you and to my calling, and that is the necessity of support for an adequate naval force to protect such merchant fleets as may fly our flag. History teaches us that no nation has ever become great or remained great upon the sea unless possessed of and utilizing to its full advantage an adequate efficient Navy."

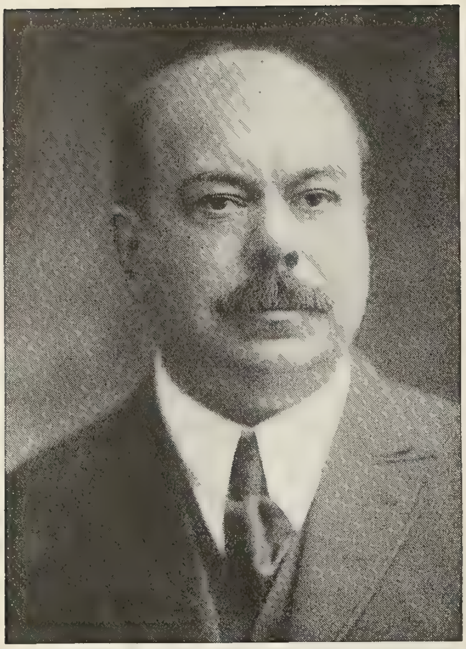








Views of Exhibits at the Marine Exhibition



C. H. Potter, President, Maritime Association of the Port of New York

Col. E. A. Simmons, President, American Marine Association

W. M. McFarland, President, Society of Naval Architects and Marine Engineers

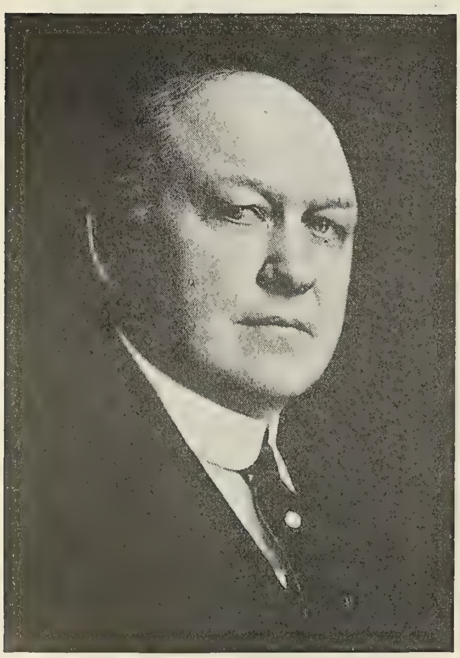
Government Radio Inspector Explains Wireless Communication

At 3 o'clock Tuesday afternoon Arthur Batcheller, chief radio inspector, Second District, Department of Commerce, delivered to an attentive audience in the auditorium of the Grand Central Palace, a most interesting and instructive address on "Radio Communication," illustrated by films and lantern slides. He explained some of the fundamental technical principles upon which radio communication is based and reviewed briefly the United States laws and international treaties relating to radio communication. In addition he described the important part that the Radio Inspection Service of the Bureau of Navigation of the Department of Commerce plays in the orderly operation of this indispensable agency of national and international commerce. Many interesting facts were brought out in the statistical data given, showing the wide range of activities covered by official, commercial and amateur radio installations.

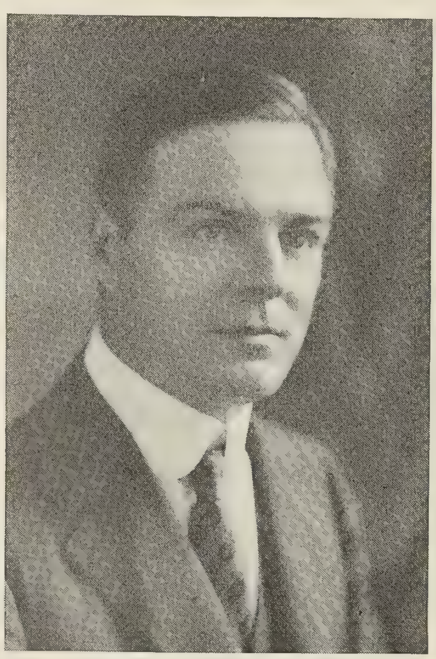
A Big Smoker

On Tuesday evening a large smoker was given by the Ocean Officers' Conference in the auditorium of the Grand Central Palace which was presided over by Mr. William Murray. A very interesting program, consisting of motion pictures, vaudeville and addresses was enjoyed by masters, mates, pilots, engineers, radio telegraphers and their friends. The Tidewater Oil Company furnished every one with a pipe and a can of tobacco.

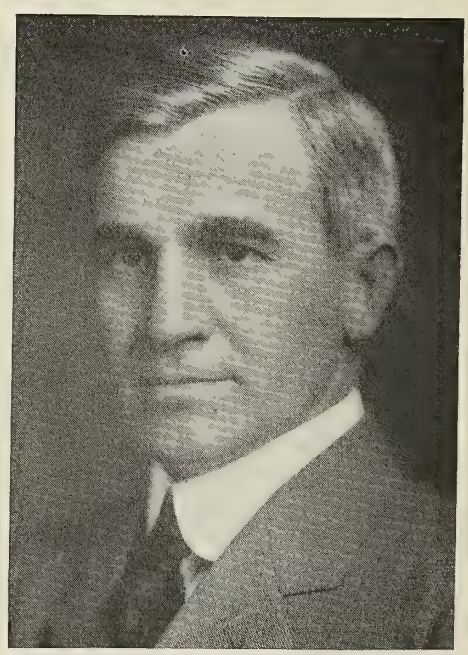
Mr. F. V. Smith of the General Electric Company gave a very interesting lecture on "Ship Propulsion" and told what the General Electric Company had done in developing the electric drive.



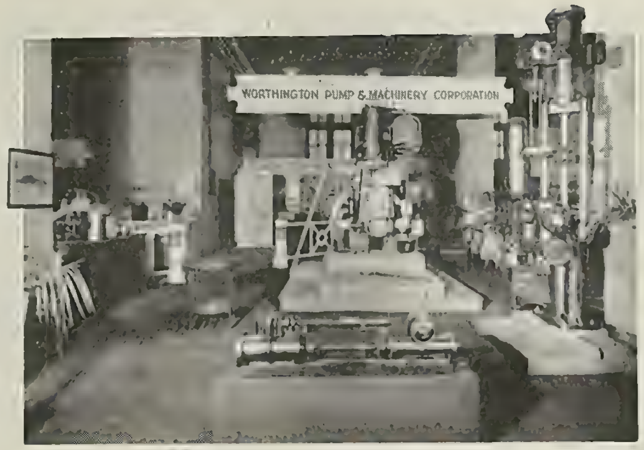
H. H. Raymond, President, American Steamship Owners' Association

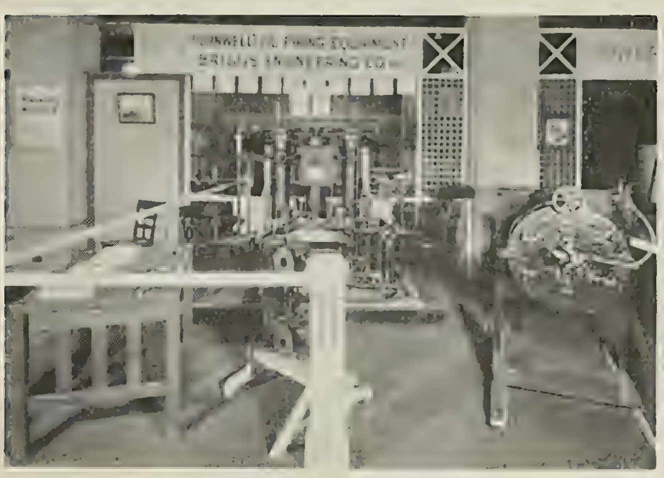


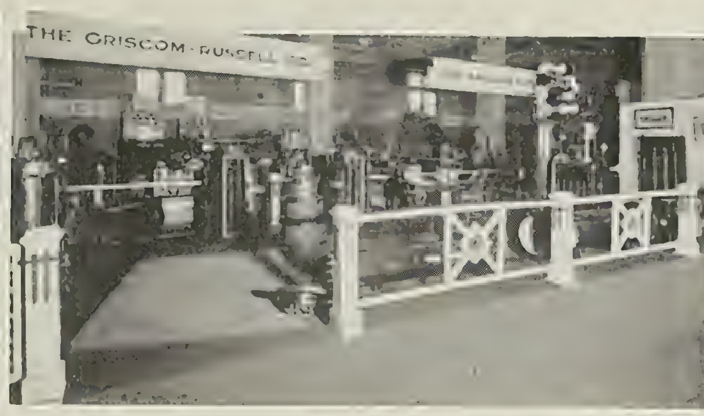
J. L. Ackerson, President, Atlantic Coast Shipbuilders' Association

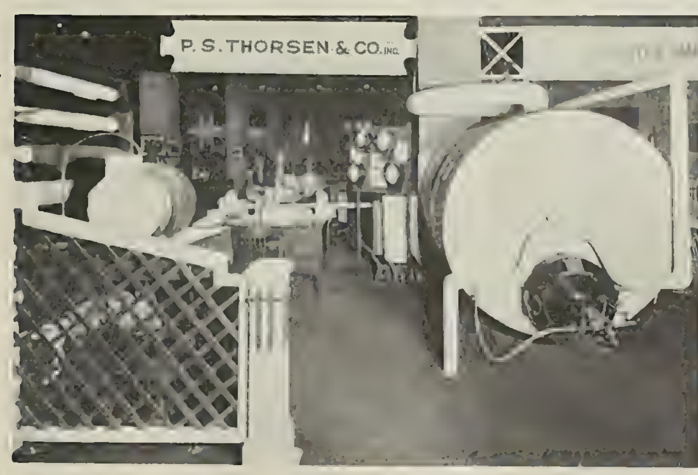


Homer L. Ferguson, President, Newport News Shipbuilding Company







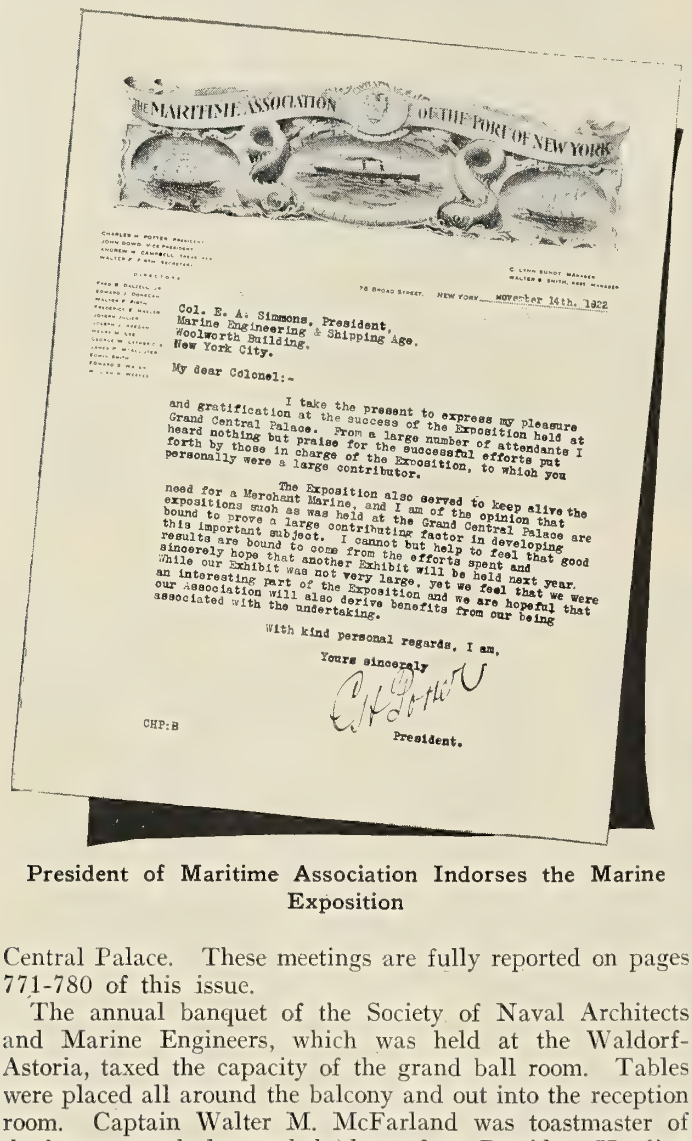


Views of Exhibits at the Marine Exhibition

Captain John F. Milliken of the Neptune Association spoke about the wages that would have to paid to competent officers on American ships in order to prevent them from taking positions on shore. Mr. Samuel Lamont spoke on "Thrift." The Sperry Gyroscope Company furnished a moving picture entitled "The Romance of the Gyro."

Convention of Naval Architects and Marine Engineers

On Wednesday and Thursday the Society of Naval Architects and Marine Engineers held their thirtieth annual convention in the auditorium of the Exposition Hall, Grand



The Maritime Association of the Port of New York

76 Broad Street. New York November 14th. 1922

Col. E. A. Simmons, President,
Marine Engineering & Shipping Age,
Woolworth Building,
New York City.

My dear Colonel:-

I take the present to express my pleasure and gratification at the success of the Exposition held at Grand Central Palace. From a large number of attendants I heard nothing but praise for the successful efforts put forth by those in charge of the Exposition, to which you personally were a large contributor.

The Exposition also served to keep alive the need for a Merchant Marine, and I am of the opinion that expositions such as was held at the Grand Central Palace are bound to prove a large contributing factor in developing this important subject. I cannot but help to feel that good results are bound to come from the efforts spent and sincerely hope that another Exhibit will be held next year. While our Exhibit was not very large, yet we feel that we were an interesting part of the Exposition and we are hopeful that our Association will also derive benefits from our being associated with the undertaking.

With kind personal regards, I am,

Yours sincerely

C H Potter

President.

CHP:B

President of Maritime Association Indorses the Marine Exposition

Central Palace. These meetings are fully reported on pages 771-780 of this issue.

The annual banquet of the Society of Naval Architects and Marine Engineers, which was held at the Waldorf-Astoria, taxed the capacity of the grand ball room. Tables were placed all around the balcony and out into the reception room. Captain Walter M. McFarland was toastmaster of the banquet and also read the letter from President Harding which appears on page 756.

Secretary Denby's Address and Message from the President

The chief speaker of the evening was the Hon. Edwin Denby, Secretary of the Navy, whose address was enthusiastically received and applauded. Secretary Denby left no doubt in the minds of his audience that the Administration was determined that the Navy should be kept equal to that of any other country and that it would do everything in its power to establish the American merchant marine on a firm basis. Part of his address follows:

"A Navy as large as any other is the best security against war as well as the surest guarantee that if war comes it will be waged successfully by our country. If people could only realize that in a peace-loving Republic like ours which has no aggressive designs in the world, a reasonable preparedness is not alone our surest guarantee of peace but it is a duty we owe to humanity. A proper Navy does not mean aggression but it does mean the exact reverse. As a nation we have too frequently acted as did the village council which solemnly resolved that the volunteer fire apparatus should be put in a state of repair and well furnished twenty-four hours before each fire.

Merchant Marine Support Necessary

"Fine as it is, the Navy cannot properly function in time of war without other aid. Napoleon once said that an 'army travels on its belly,' meaning that it must have its supplies and its train or it could neither move nor fight. Exactly the same thing is true of the Navy. It cannot fight in distant waters nor travel without its supplies—its fuel ships, its refrigerator ships, its hospital ships, its repair ships, its mother ships for the smaller craft. It would be a vast expense in time of peace to maintain as naval craft only the great fleet that would be needed when the call to battle comes. We have been compelled to rely upon the merchant shipping of the United States to secure in large part these vitally necessary adjuncts to the fighting fleet.

"When President Roosevelt made that splendid experiment of sending twelve battleships around the world, I think he had more motives in mind than one. Among other things, I think he wanted to show the American people the vital need of the merchant marine. Those 12 ships could not have gone around the world or to any distant waters in time of war. We had not the necessary auxiliaries nor the necessary merchant vessels of which auxiliaries could be quickly made and so we chartered foreign shipping and the American armada was made possible by the use of vessels flying foreign flags. It was a striking demonstration of the military need of a merchant marine.

"Yet a more striking event occurred during the Spanish-American War when it was found almost impossible to assemble together enough ships to carry a force of 25,000 men to Cuba. And I well remember how we who were in the Navy then prayed that no wind might blow nor seas rise while these old vessels carried their precious cargoes to the scene of war. This too was because we had no merchant marine worthy the name and only gathered in by hook and by crook enough vessels to actually take the troops that short summer cruise. Had the war been more distant, the season different, and the weather inclement, a pitiful disaster might have befallen the American arms. We of the Navy regard the continuance of our present merchant marine and its increase as a vital necessity for the national defense.

The Country Is Awakening

"I am happy to say there seems to be an awakening now in the United States and it is my earnest hope and belief that that awakening will stir us to pass through Congress at the next session a bill which will encourage and make possible the building and operation of American ships by the employment of the only method we have at present—a subsidy. It will be a subsidy of so peculiar character, however, that it is to be expected that vessels receiving it will in the course of not many years be able to pay back into the treasury all the money advanced by the United States to aid in their operation and I am very happy to tell you what you doubtless know already that the recreation of the American merchant marine is a policy very dear to the heart of the President of the United States. His utterances have shown how earnestly he will endeavor to secure legislation at the special session of Congress, which he has just called for November 20, to keep the flag upon the high seas and to aid the merchants of the United States in their coming struggle for their fair share of the trade of the world. I am authorized by the President to read to you a message of greeting and encouragement."

This message appears on page 756.

Mr. W. J. Love, vice-president of the Emergency Fleet Corporation, gave some very interesting facts comparing our position on the sea in 1916 versus 1922. Extracts follow:

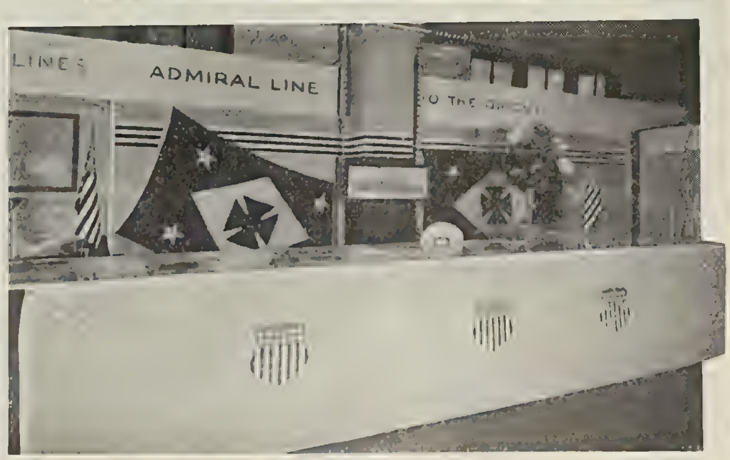
"The entrance of our country into the World War in April, 1917, found our shipping in a deplorable condition, at least with respect to world wide cargo trading, and my entire remarks are on this basis, that is, excluding services to contiguous countries, to the West Indies and Central America. A brief description will be helpful.

Review of Shipping

"On the Pacific there were, I think, only two American flag steamers trading to the Orient—the *China* and the famous *Minnesota*—and those to Australia via our South Sea Island possessions, the old established Pacific Mail Company service to the Orient having disappeared about a year previously.

"There were perhaps eight or ten ships under our flag trading to Central America and the West Coast of South America.

"Off the Atlantic Coast we had the American Line to South-



Views of Exhibits at the Marine Exhibition

ampton, and one or two passenger ships to Antwerp. The Atlantic Transport Company was using the recently acquired ships of the Pacific Mail in its London trade.

"The splendid fleet of the American Hawaiian Company was principally engaged in the Intercoastal trade and to the Hawaiian Islands.

"The fleet of the United States Steel Company was in its infancy, they having a few steamers trading with their products and general cargo in various directions.

"This will give you a fair picture of the activities of American ships in world commerce prior to the war.

Development Since 1917

"Let us now look at what has been done in the development of privately owned lines since 1917. On the West Coast there are two passenger trading ships transpacific, two leading to Australia, and perhaps a dozen cargo steamers to the Orient, Central America and South America. On the Atlantic, we have two excellent services to German ports, and one of our largest manufacturing concerns has increased its fleet to well over 40 bottoms that cover many important trade routes.

"The Intercoastal trade, which is a restricted one, is absorbing today between 600,000 and 700,000 tons of the best American ocean-going cargo ships. Of course, this tonnage would be available in time of war for any service it might be called upon to fulfill.

"This comparison, therefore, of our position in 1916 vs. 1922, is anything but a pleasant one, for it shows that so far as privately owned shipping is concerned we have made little or no progress in developing services to move our exports or imports in world-wide trading. If it is the country's wish that we have a merchant marine then it can only be successful in private hands who will by energy, ambition, and resourcefulness, if proper laws are enacted, place it in a position to compete freely with the flags of other nations. While it is true that many maritime nations operate ships under restrictive laws, as a rule owners are generally free to take advantage of every means at their disposal to reduce costs of operation to the lowest possible point, and this during periods of depression simply means 'the survival of the fittest.' Are we headed that way, or are we headed the other way? Countries whose laws are too harsh reflect this lack of commercial freedom in the size of their commercial fleet."

Pay Necessary Cost

Homer L. Ferguson, president of the Newport News Shipbuilding & Dry Dock Company, spoke as follows:

"Conditions have changed to such an extent in recent years that it is difficult to see how American papers and American men can be against all laws that will foster the development and growth of the merchant marine.

"We live in a protected country and that our marine must be protected seems proven both by reason and experience.

"Discriminating duties as provided by the law of 1920 having been declared by two Presidents to be out of the question at this time, we are forced to consider the recognized alternative of subsidy.

"We paid so much for lack of merchant vessels during the war that any reasonable cost for subsidy appears trivial by comparison.

"The necessity for merchant vessels, particularly of large fast types, was such as to demonstrate their usefulness to be on a parity with that of war vessels.

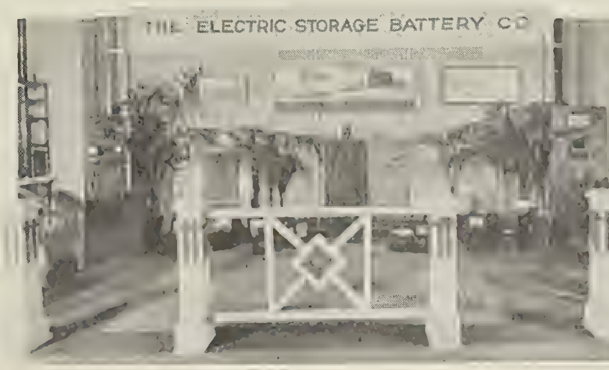
"The limitation of capital naval ships further emphasizes the value of merchant ships, and inevitably transfers the competition from what may not be built to what may be built. The 5-5-3 ratio can only be maintained by providing in practically that ratio all of the necessary elements of naval power including merchant shipping suitable for carriage of troops, and capable of conversion into auxiliary cruisers.

"Otherwise, it follows, we will be left behind and not only will our shipbuilding decay and our shipping industry fade away to its former insignificance, but our position in the world will have been given away without the people knowing it.

"How can anyone believe in the national necessity for an effective merchant marine and not believe in paying what is necessary

View of Center Aisles, Marine Show, Grand Central Palace, November 4-11, 1922

THE ADAMS & WESTLAKE COMPANY



Views of Exhibits at the Marine Exposition

to get it? How can anyone believe in preparedness and in a proper Army and Navy and not believe in providing that great and necessary auxiliary to each—an effective merchant marine?

"Every sound argument for preparedness applies equally well. Free traders and those who believe the earth is rid of wars, will generally oppose doing anything to provide our country with such a prime necessity as a merchant marine. The costly experience of the past few years is lost on them. But our trade and our policies will not always be dominated by others and some day we will share in fair partnership on the sea with the other great nations."

American Marine Association Holds Annual Meeting

The annual meeting of the American Marine Association to discuss the work of the year, the success of the exposition and the reports of committees and finally the election of new officers, held in the Auditorium of the Grand Central Palace, Friday afternoon, was opened at 4:30 o'clock with Col. E. A. Simmons presiding.

In his opening talk the president outlined informally the original purpose for which the association was formed, the gradual development of its powers and broadening of the scope of its activities until it has reached the point this year when over eighteen associations actively engaged in the marine field have been interested in making American Marine Week a success.

With reference to the development of the association and its future possibilities, Colonel Simmons outlined the proceedings of the informal conference on standardization in ship construction and ship operation held in the auditorium that morning and referred to the proposed plan to subdivide the American Marine Association into several parts, such as designing, engineering, purchasing, etc., each part to co-operate with other existing organizations to the end that during the year papers on various subjects would be prepared for presentation and discussion at next year's meeting.

In concluding his address, Colonel Simmons thanked Vice-President Wampler and the members of the several committees, through their respective chairmen, for their tireless energy and splendid co-operation, attributing to them the success of the show and the activities connected therewith.

Following the report of the Secretary, the President called for the report of the Nominating Committee. He explained that while the by-laws provided for the selection, as well as the election, of members of the Executive Committee for the several districts by the members having their offices in those districts, the Nominating Committee had taken it upon itself to recommend men to fill existing vacancies and to provide for vacancies which would occur at the end of the year through expiration of terms of office—the reason being that the Nominating Committee consisted of men from all six districts able to canvass the situation in advance. It was then decided that the representatives from the several districts would act on any recommendations so made by the Nominating Committee. The result was that the following were elected:

District 1. New England States—Charles F. Scott, General Electric Company.

District 2. New York and New Jersey—William Wampler, Ellcon Company; L. H. Korndorf, Federal Shipbuilding Company.

District 3. Pennsylvania, Maryland, Virginia, etc.—James Plummer, Newport News Shipbuilding & Dry Dock Company.

District 4. Gulf States—Ernest Lee Jahncke, Jahncke Dry Docks, Inc.

District 5. Middle West and Great Lakes States—F. C. Bradbury, Crane Company; W. S. Doxey, *Marine Review.*

District 6. Pacific Coast States—H. F. Alexander, Pacific Steamship Company; J. J. Tynan, Bethlehem Company.

Through recent amendments to the by-laws it was necessary to elect two officers only, selection of a Secretary and a Treasurer being left to the Executive Committee. The report of the Nominating Committee recommended the re-election of Colonel E. A. Simmons, of Marine Engineering and Shipping Age, New York, as President, and the election of Frank J. Shipman, of the Texas Company, New York, as Vice-President. They were then elected unanimously.

There was some expression of surprise that William Wampler, of the Ellcon Company, had not been re-elected Vice-President. The fact is that the office was tendered to him by the Nominating Committee and Mr. Wampler declined only because of his inability to give to the affairs of the association the amount of time required.

Maritime Association Day

Saturday, November 11, was Maritime Association Day and Armistice Night. In the afternoon Captain John F. Milliken of the Neptune Association gave an interesting talk on the part that the sea-going personnel had played in the history of our country. Captain Milliken pointed out that during the Revolutionary War the number of sailors on our men-of-war, privateers and merchant ships exceeded in number those in General Washington's Army. He also said that we had more men on the sea than in the Army in the War of 1812.

The Coast Guard

A paper explaining the duties of the Coast Guard, which was prepared by Commander B. L. Reed, was read by Captain Yardell. Commander Reed said that "While the Coast Guard is a military service available for active duty in time of war under the Navy Department, its prime duties are humanitarian, and, in general, have to do with rendering assistance to vessels in distress and saving life and property; destruction or removal of wrecks, derelicts, and other floating dangers to navigation; extending aid to American vessels engaged in deep sea fisheries; protection of the customs revenue; enforcement of law and regulations governing anchorage of vessels in navigable waters; enforcement of laws relating to quarantine and neutrality; suppression of mutiny on merchant vessels; enforcement of navigation and other laws governing merchant vessels and motor boats; enforcement of law to provide for safety of life on navigable waters during regattas and marine parades; protection of game and the seal and other fisheries in Alaska; enforcement of sponge-fishing law; the conduct of the International Ice Patrol for safety at sea off the Grand Banks.

Other papers prepared for the American Marine Week appear elsewhere in this issue.

Electric Drive Control Panels

Two types of electric ship propulsion control panels for turbine and Diesel electric drive were features of the General Electric Company exhibit at the Exposition.

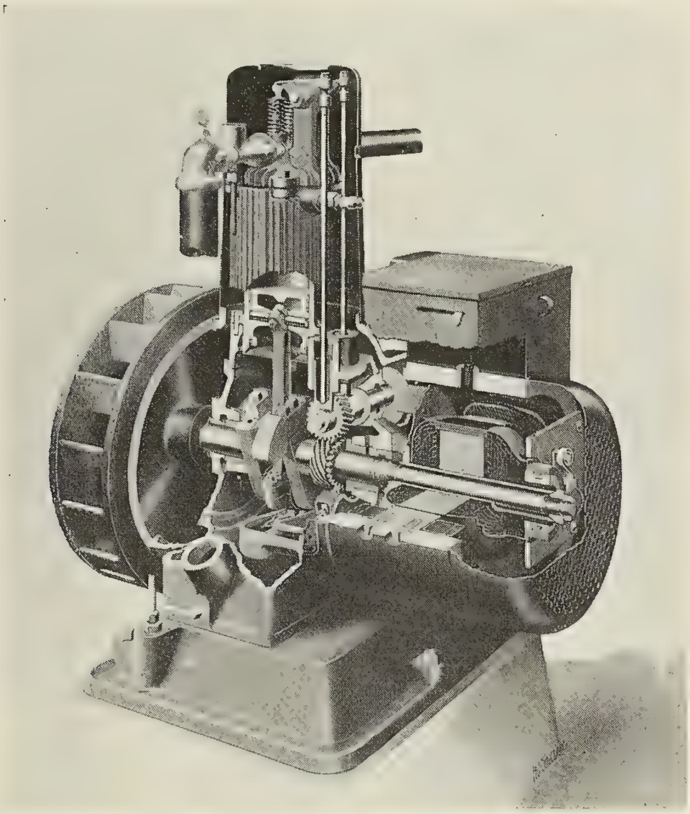
The steam turbine drive control panel was built for the San Francisco-Oakland Terminal Railways. The propulsion equipment with which it is to be used consists of a direct current turbine generator with exciters. The generator is connected to the turbine through single reduction gears. Two motors drive the propellers, the bow motor being run at such a speed that no work is done by its propeller. The astern motor develops 1,100 shaft horsepower.

The Diesel electric control panel on exhibition was a duplicate of that used on the *Golden Gate* in conjunction with the two Diesel engine driven direct current generators driving two motors. The astern motor in this case develops 750 horsepower. This control panel contained the switches for the three control stations; one station in the engine room and one in each pilot house. These switches are so arranged that only one station can be used at a time.

New Devices Exhibited at the Marine Exposition

Marine Light and Power Plant

TWO small marine power plant units recently put on the market by the Westinghouse Electric & Manufacturing Company, New York, were exhibited at the Exposition. These units of $1\frac{1}{2}$ horsepower and 3 horsepower, respectively, are suitable for supplying the necessary current for light and power for auxiliary equipment on small yachts, cruisers and other pleasure craft. They are equally applicable to auxiliary or emergency service on larger ships for signal and deck lights as well as supplementary power in case of accident to the main generating equipment or when the vessel is in port.



Westinghouse Type E-30 Light and Power Plant, with 750-Watt Generator and 4500-Watthour Battery (8 Hour Rate).

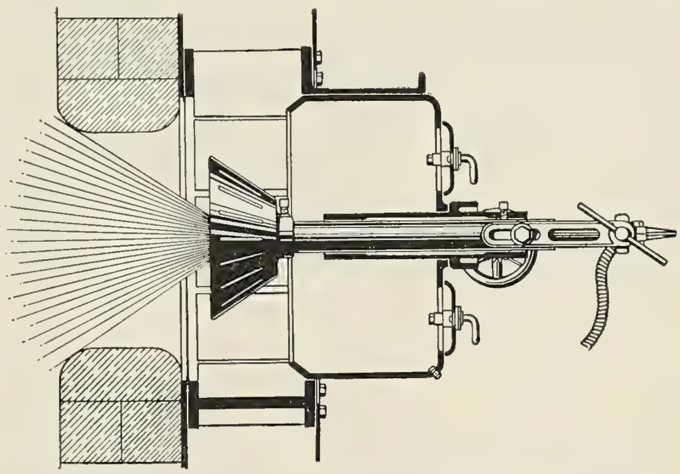
The smaller outfit is driven by a 4-cycle, single cylinder, air-cooled engine, operating on either gasoline or kerosene and runs at 1,250 revolutions per minute. The weight without the battery is 338 pounds. The generator output is 750 watts.

The 3 horsepower unit is run by a similar type engine at 1,200 revolutions per minute and weighs 485 pounds, while the generator output in this case is 1,500 watts at 30 volts.

Batteries supplied with the equipment are of 4,500 or 6,000 watt hour capacity with a weight of 600 pounds for the former and 904 pounds for the latter.

Swinging Front for Oil Burners

THE Bethlehem (Dahl) mechanical oil burning equipment has been improved by the new swinging front which may be used with both natural and forced draft. This new front combines all the features of the regular burners, including the slotted cone, the nine vane air register and hand ratchet adjustable pot air valve. Probably the greatest advantage claimed for the new front is that access to the furnace may be made without taking down the front. The front may be swung aside by simply moving two dogs and removing one lock pin. The front half of the pot swings open with the front itself, leaving the vanes of the air register locked, so that in the case of forced draft any one of a battery of furnaces may be opened without interfering with the draft in the others.



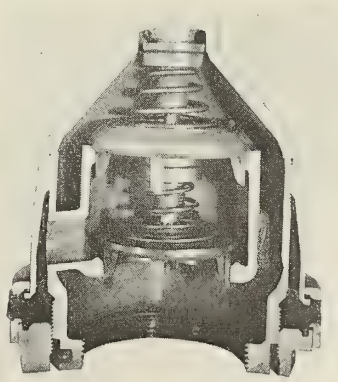
Improved Type of Bethlehem (Dahl) Oil Burner

Cone adjusting handles have also been added and a peep hole cut in the slotted cone which lines up with a peep hole in the door so that the operator can observe the flame at the burner tip from in front of the furnace.

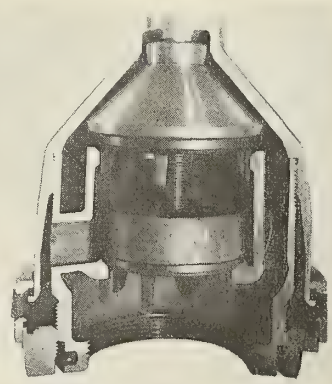
Three Luckenbach ships which are being equipped with the largest Scotch marine boilers ever built are being fitted with this new type front—forty-eight furnaces in all.

Automatic Tank Vent Valve

THE exhibit of the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa., included among other devices the de Krafft automatic tank vent valve, designed for use on the vent pipes of oil tanks so that in case of accident, such as a collision or grounding, where a tank is punctured and there is danger



Adjustment with Springs on Disks



Adjustment with Weights on Disks

of it filling with water, the valve may be quickly closed, completely stopping vent pipes and preventing the escape of the air from the tank and the water from entering it.

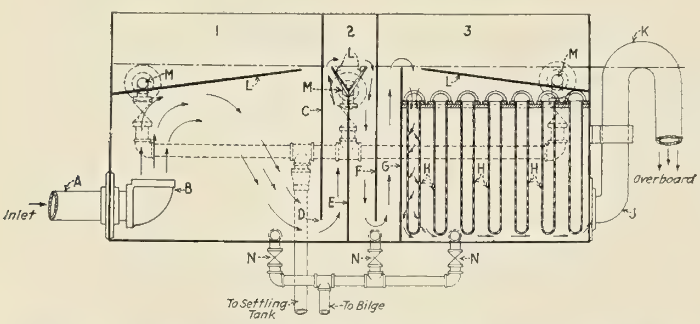
In the device there are two separate valve disks seating on separate seats instead of one disk being seated upon the other. Both of the disks open upward and close downward by gravity instead of one disk opening downward and being held in its place by a spring; the danger of this disk falling open through accident to its spring thus being avoided. The pressure at which it is desired to have the disks operate may be controlled by springs or by means of weights. A wire net screen around the bottom is provided which prevents dirt from entering the valve and acts as a protection against fire. This screen also serves as an indicator to show whether the valve and vent pipe are open or closed.

When the tank is being filled and a pressure is caused in it, the lower disk lifts and the air escapes through the ports and the screen into the air. While the tank is being emptied, a vacuum is caused in it, the air in this case entering the valve through the screen and the ports to the chamber over the lower disk, lifting the upper disk and flowing into the tank through the passage between the ports.

This valve has passed a series of severe tests by the United States Navy Department, and is approved by Lloyds' Register of Shipping, the American Bureau of Shipping, the United States Salvage Association and others.

Bilge and Ballast Oil Filter

For the prevention of pollution in harbor waters by the discharge of ballast and bilge water from oil-burning vessels the Todd Shipyards Corporation has developed a filtering system which was exhibited for the first time at the Marine Exposition. The system consists of moving water by gravitation and filtration by passing the



General Arrangement of Todd Bilge and Ballast Filter Tank

overboard discharge from the bilge and ballast pumps through a specially constructed filter.

The main body of the filter consists of a rectangular sheet metal tank located at any convenient point above the load water line of the vessel. This tank is subdivided into three or more ompartments, designated in the accompanying illustration as 1, 2 and 3. The overboard discharge, consisting of water and oil, from the pump enters the filter tank through pipe *A* into compartment No. 1 and is deflected upward by elbow or bend *B*. Compartment No. 1 being relatively large, acts as a reservoir, and this permits the major portion of the oil contained in the discharge sufficient time to flow to the top of the level in this compartment.

The flow from compartments 1 to 2 is baffled by a division plate *C*, which is open on the bottom only at *D*. Compartment 2 is also fitted with a division plate *E* which forces the water to flow up over it and down behind a third division plate *F*, which is similar to *C*, and separates compartments 2 and 3. The flow of water under and over these baffles permits the oil to rise to the top, due to its lighter gravity, and the final flow into compartment 3 over baffle *G* is relatively free from oil. The water is then passed through filtering cloths *H*, and these cloths entirely eliminate the final particles of oil. It is then carried overboard through pipe *J* and return bend *K*.

Each compartment is fitted with a skimming pan *L* and drain cocks *M*, whereby the oil which floats to the top of the various compartments can be drained from the filter into a settling tank. Each compartment is also fitted with a clean out valve *N*.

Fireroom Temperature Reduced with New Air Register

A feature of the Coen Company, N. Y., exhibit was the air register similar to the type which was developed for installation on the S. S. *President Taft* of the Pacific Mail Steamship Company.

A unique method of obtaining full air openings in the vane wheel has been devised. This wheel slides into position on double threads. Ready access to the interior of the furnace may be had through the front, which is hinged and may be swung aside without the necessity of dismantling any of the parts.

The fireroom records of the *President Taft* on a trip to Japan indicate that the air registers operated satisfactorily, maintaining an average fireroom temperature for the voyage of 90 degrees F., whereas with the former equipment the average temperature was 120 degrees. The air registers on this ship are fitted to Yarrow boilers.

New Balanced Window Sash

An ingenious window sash just perfected by O. M. Edwards, Inc., Syracuse, N. Y., was among the new devices shown at the exposition. The window is balanced by a spring actuated mechanism consisting of two levers with rollers at the outer ends upon which the glass rests. Balancing is accomplished by a compression coiled spring with arrangements for adjustment to correspond with the weight of the glass. All of the mechanism is located above the sill, which prevents the accumulation of water and consequent rusting of the mechanism.

Four Soundings a Minute with New Device

The "Marimeter," patents for which are controlled by Wm. Cramp & Sons Ship and Engine Building Company, was demonstrated at the Exposition by the inventor, Samuel Spitz. The principle on which the device operates is measurement of the time interval between the moment a blow is struck on the ship's bottom by an electric hammer until the echo is reflected from the sea bottom and transmitted back through the water and picked up by a microphone on the ship.

The equipment includes a pedestal located on the bridge, on which is mounted an electric keyboard and an indicator. Microphones are placed on the ship's bottom, on either side of the hull and at the bow. As noted, when a key is pressed a sound is produced at the ship's bottom. Immediately the indicator needle starts moving from zero and continues until the echo is picked up by the microphone, at which instant it stops. The dial is calibrated in fathoms so that the sounding may be read directly.

The apparatus may also be used to determine the distance from one ship to another, to land, an iceberg or other marine

menace. The Navy Department in testing the device has made soundings up to 28,000 feet, at the rate of four soundings a minute.

Sturtevant Sea Speed Engine

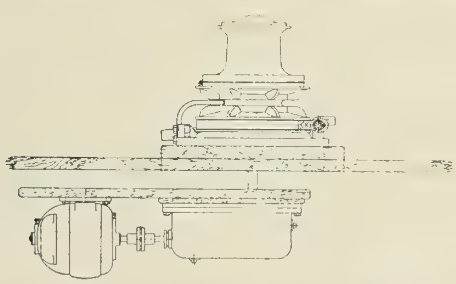
A LITTLE known product of the B. F. Sturtevant Company, Hyde Park, Mass., was exhibited this year—a 75 horsepower gasoline engine especially developed for speed boats.

This engine is of the 4 cylinder four cycle, water cooled vertical type with a bore of 4½ inches and a stroke of 6 inches. It is designed to operate continuously at a speed of 1,500 to 1,600 revolutions per minute. Right and left hand rotation designs are supplied so that a pair of engines may be installed symmetrically in a boat.

Electric Windlasses for Motor Boats

THE American Engineering Company, Philadelphia, Pa., in its exhibit featured small windlasses of the gypsey head and wildcat types especially developed for use on motor boats. The gypsey type unit is driven by a 1/3 horsepower weatherproof marine motor connected through a flexible coupling to the gearing of the gypsey head. The barrel of the windlass is of bronze 5 inches in diameter. The overall dimensions of the machine are: Fore and aft, 26 inches; thwartship, 11 inches; depth below deck, 8 inches; height of gypsey barrel, 7½ inches; weight, 100 pounds. This will lift a 200-pound anchor or loads on the barrel up to 1,000 pounds.

The gypsey barrel wildcat type windlass is equipped with either a 1/3 horsepower or ¾ horsepower weatherproof marine



Gypsey Barrel Wildcat Type Windlass

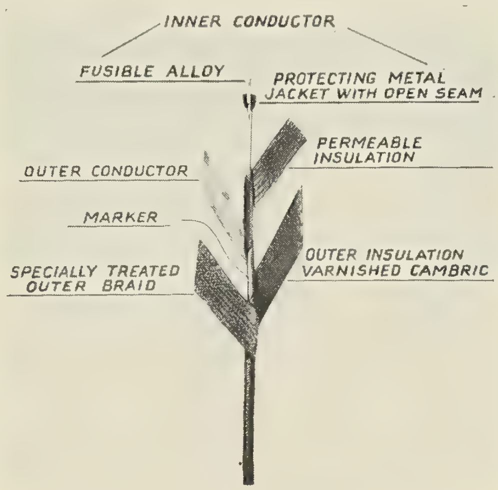
motor. The smaller motor will handle an anchor up to 150 pounds, while the larger will lift 300 pounds. The wildcat can be made to handle chain from ⅜ inch to 9/16 inch inclusive. A toggle operated self-contained brake is furnished, also a deck pipe for the chain. The weight of the unit depending on the size of the motor is from 125 to 150 pounds.

Fire Detecting Wire Automatic Alarm System

A CLOSED circuit automatic fire alarm system depending upon the fusibility of a special type wire, known as "Fire Detecting Wire," was demonstrated at the exposition by the Fire Detecting Wire Corporation, New York.

The system on board a ship consists of various circuits of continuous thermostatic wire each connected with a centrally located control panel and with alarm gongs so that in the event of fire or even of undue heat in any of the compartments an alarm will be given before the fire has become dangerous. The construction of the wire is illustrated below. It is composed of a core of special fusible alloy covered with a protecting metal jacket having a narrow open seam. Next to this is a wrapping of saturated cotton yarn which provides insulation between the core and the outer conductor which is of spirally wound brass tape. A layer of varnished cambric protects against grounds and a varnished cotton braid over all gives mechanical protection.

The soft metal in the core has a fusing temperature of



Construction of Fire Detecting Wire

160 degrees F., but, because of the retarding effect, amounting to 20 degrees F., of the outer casing, the wire as a whole has a fusing temperature of 180 degrees, although in a slow heat the fusing point is reduced to approximately 160 degrees since the entire mass has time to become thoroughly heated.

In operation the soft metal core first becomes plastic, and at the instant of fusing spurts through the permeable insulation making electric contact with the outer conductor or brass tape. This contact operates the system and sounds the alarm.

An installation may be either code or non-code, according to requirements. In the code system single stroke gongs are placed at various points in the protected area. The fusing of the wire in any circuit will cause the code number for that section to be sounded on all gongs in the system. Each section is provided with an alarm box by means of which the system can also be operated manually.

In the non-code system each section of thermostatic wire is led to a centrally located control panel on which is mounted an indicator having a drop for each compartment. The fusing of the wire in any circuit shows on the indicator the section affected and rings a series of vibrating gongs located at various points in the protected area.

Features of Ice Machine Exhibit

AMONG the various types of ice machine equipment shown by Brunswick-Kroeschell Company, New Brunswick, N. J., was a new design of piston valve engine driving a 2-ton ice machine. The complete compression side of this machine was shown.

The engine is the latest type steam reciprocating engine developed for ice machine service, having in addition to the piston valve feature a channel frame which permits ready access to the connecting-rods and stuffing box.

One of the few direct motor driven ice machines was also shown. This unit consists of a 1-ton ammonia outfit driven by a 3 horsepower motor.

As a result of the recent consolidation of the Brunswick Company with Kroeschell Brothers, of Chicago, a Brunswick-Kroeschell carbon dioxide machine was also included in the exhibit.

Measuring Liquids at High Temperatures

IMPROVEMENTS in the Empire fuel oil meter make possible the measurement of liquids at high temperatures. The standard type meter for measuring fuel oil on board ship produced by the National Meter Company, N. Y., will withstand a working pressure of 300 pounds per square inch and a hydrostatic pressure of 600 pounds per square inch. This meter has been approved by the United States Navy and in the reconditioning of the *Leviathan* nine meters are being installed.

Electric Telemotor Perfected

THE Hyde Windlass Company, Bath, Me., exhibited a new and original application of the induction principle to an electric telemotor. This telemotor has been developed at the company's laboratory recently in order to furnish a dependable steering apparatus for steamships.

By moving the steering wheel in the pilot house any angle of rudder is automatically obtained. This is a contactorless type telemotor having a positive follow-up. Only three small wires are required between the steering wheel in the pilot house and the steering gear aft. The telemotor was shown operating two types of electric steering gears.

Utilizing Waste Heat from Diesel Engines

REPRESENTATIVES of Row and Davis' Engineers, Inc., N. Y., took special interest in explaining a new steam generating outfit developed by the company for extracting heat from the exhaust of Diesel engine installations.

The steam thus generated is available for heating a ship and for such purposes as supplying steam to the RanD system for rendering fuel oil mobile, without the use of tank heating coils.

Two ships, the *City of Jacksonville* and the *Ashby,* are already equipped with the new steam generators.

Largest Brass Valve in the World

The Crane Company exhibited in its booth the largest brass valve ever made. This valve, which was built for the United States Navy, is a 39-inch gate type and weighs 4,600 pounds.

Protective Coating for Insulated Surfaces

WHEREVER magnesia and other insulating materials are used on boilers, tanks, feed water heaters, oil heaters and in other applications "Thorkote" a product exhibited by P. S. Thorsen and Company, 81 Coffey street, Brooklyn, N. Y., may be applied as a waterproof covering. This material is in plastic form when it is applied to the insulating covering. After application it becomes hard, but may be easily repaired.

The advantages claimed for "Thorkote" are the fact that it is cheaper than sheet iron, has insulating qualities itself, is waterproof, has no open seams, thus eliminating the chance for water reaching the magnesia, and cannot rust.

New Soot Blower Head

THE Diamond Power Specialty Company, Detroit, Mich., exhibited the model G-2M blower head designed especially for marine work, in restricted spaces. It has a minimum projection from the casing of a watertube boiler of 7½ inches. Special features include the stuffing box, packing gland, stop system and chain operation.

The front end blower for Scotch marine boilers also exhibited is designed for cleaning double end boilers where the space between the rear of the boiler and the bulkhead makes necessary the operation of the soot blower from in front of the boiler. The device is operated through the flue doors. No threaded parts of the blower are exposed to the steam.

Diesel Electric Drive

FOR purposes of illustrating the application of Westinghouse direct current motors and generators to Diesel electric ship propulsion, a complete model layout of a typical installation was shown in the Westinghouse booth. The electric equipment is adaptable to practically any make of Diesel or semi-Diesel type engine.

The features of electric drive especially emphasized by the demonstration are flexibility of the control which is based on the Ward Leonard system of operation, the fact that the most economical engine speed may be maintained at all motor speeds and that in case of trouble one unit may be cut out and repaired with only a slight reduction in the speed of the ship.

Casting Metals by the Centrifugal Process

A NUMBER of highly polished cylinders of cast bronze made by a new centrifugal method of casting non-ferrous metals were included in the exhibit of the American Manganese Bronze Company, Holmesburg, Pa. Pump lines, bushings and gear blanks for marine work are cast almost to size, with a minimum of material left for finishing. The process consists in rotating specially constructed molds at a high rate of speed and pouring in the molten metal. The metal solidifies and forms the casting almost instantaneously. The assurance of homogeneous, close grained castings without flaws is claimed for the new process.

Submarine Signal Oscillator for Lightships

A NEW type submarine signal oscillator especially developed for lightship service was demonstrated at the Marine Exposition by the Submarine Signal Company, Boston, Mass. This new producer of submarine signals is a modified form of the Fessenden oscillator which is the most powerful generator of submarine signals ever devised. The new oscillator is much lighter than the Fessenden type, having substantially the same weight as the automatic bell now in service on light vessels.

The oscillator can be readily substituted for the bell on lightships and can be suspended from the davit now provided. The new equipment includes a rugged power plant which supplies the electrical energy required for the operation of the oscillator.

Naval Architects and Marine Engineers Hold Thirtieth Annual Convention During American Marine Week

President of Society Says Passage of Subsidy Bill Will Benefit Whole Country—Abstract of Papers and Discussion

THE thirtieth annual convention of the Society of Naval Architects and Marine Engineers, which was held this year in conjunction with the Marine Exposition at the Grand Central Palace, New York City, was opened at 10:30 A. M., Wednesday, November 8, by Walter M. McFarland, president of the society.

Secretary-Treasurer Daniel H. Cox in discussing the record of membership in the society stated that this membership, which shows a total of 1,631 in all grades, is excellent but that the society under conditions in the industry will do well if these figures are maintained. The increased membership as a result of abnormal shipbuilding activity during and for a short time after the war could not be maintained, as many of those who were engaged in shipbuilding operations who became members of the society have now returned to former occupations and, as a result, have resigned from membership. A number of new members have been admitted to the society, however, and applications are being received so that the coming year will probably show no decrease in the rolls of the society. The secretary's report showed the financial condition of the society to be very good, with a substantial increase in the endowment fund for the past year.

Election of Officers

The following officers were elected for the terms indicated:

Honorary Vice-President—Joseph H. Linnard.

Vice-Presidents (for term expiring October 31, 1925)—Albert P. Niblack, Richard M. Watt, Charles P. Wetherbee, Harvey D. Goulder.

Members of Council (for term expiring October 31, 1925)—Charles A. McAllister, Theodore E. Ferris, Hugo P. Frear, W. L. R. Emmet, J. Howland Gardner, William J. Davidson.

Associate Members of Council (for term expiring October 31, 1925)—Albert G. Smith, George D. Ali.

Executive Committee—Stevenson Taylor, W. L. Capps, Andrew Fletcher, F. L. Du Bosque, J. W. Powell, H. L. Ferguson, A. G. Smith.

Committee on Papers—F. L. Du Bosque, J. H. Gardner, H. L. Aldrich.

Secretary-Treasurer—Daniel H. Cox.

Assistant Secretary-Treasurer—Thomas J. Kain.

Abstract of President's Address

The question of supreme interest for all of us just now is the shipping bill. The vital element in this bill is the recognition of the duty of the Government to encourage the merchant marine, just as it endeavors to encourage other industries in the country by means of a protective tariff.

It is very gratifying to know that the earnest efforts made to educate the people of the country, particularly in the interior, have resulted in favorable action by Chambers of Commerce, Boards of Trade and other representatives of the citizenship of the interior. These will have very serious weight with their representatives in Congress.

The President has shown a strong personal interest in the matter and has gone on record as favoring Government help for our merchant marine. Under all these circumstances we have every reason to hope for favorable action by Congress with the resultant benefit to shipowners, shipbuilders and all who have any connection with the operation or building of ships. The passage of this bill will be of great benefit to the country at large by providing an outlet for the great amount of idle tonnage.

During the latter part of the war the class of vessels known as "transports" was designed of reasonably high speed and large capacity. The Government officials wisely called in help from some of the big operating companies in the design of these vessels, with the result that they were planned so as to be readily converted into passenger and freight steamers of the "liner" type. As a matter of fact, the end of the war came before any of them were finished, so they were completed for passenger and freight steamers. All of them are now in service and giving a very good account of themselves.

It is also very gratifying to note that a considerable number (about 150) of the vessels built at the three great fabricating yards have been in service almost continuously since they were built and reflect great credit on the yards for the record they have made.

For large powers and high speed vessels the geared turbine now seems an established favorite. In the case of cargo boats, such as the ones spoken of above, a great many installations have given complete satisfaction, and there is probably little doubt that with proper care and management they are entirely satisfactory. The reduced weight and greater economy due to this type of machinery certainly is a strong recommendation.

The very high thermal economy of the Diesel engine has brought it into very serious consideration in these days of the necessity to save at every point. A recent statement gives the number of motorships afloat at about 1,450, with about 180 under construction.

The use of oil as the fuel under boilers seems to increase steadily notwithstanding the predictions of a relatively early exhaustion of the oil fields. As long as the price is reasonable, the advantages of oil fuel are so many and so great that its increased use is to be expected.

The experience in the Navy with the electric drive on the new battleships has thus far been very satisfactory, a striking instance being that of the return trip of the *Maryland* from Rio de Janeiro to this city in September of this year, where, after steady running at nineteen knots for most of the trip, the speed was increased to the highest point, over 21 knots, for the last two days and everything worked admirably.

Another form of the electric drive where Diesel engines are used as the prime mover instead of steam engines is being tried out in some vessels of moderate size and power. The limitation of the Diesel engine to small powers per cylinder has, of course, thus far ruled it out of any installation of very powerful machinery.

Automatic Steering

By Elmer A. Sperry

Abstract

THE main points that influence holding a ship on her course under service conditions are the following:

1. The general characteristic of the ship, especially as to flow of water to the rudder and the disturbances of the water by nearby propellers.
2. The general effectiveness of the rudder, as such.
3. Whether the ship is light or loaded and, when light, if she is low at the stern with large areas forward exposed to wind effect.

If automatic steering is to be of the greatest value in controlling the ship's course, one of its paramount objects must be to suppress helm. This fact alone emphasizes the importance of a guiding element that is instantly and minutely responsive, to be employed as a base line so that the slightest departure from the course may be utilized to apply the correction.

No magnetic compass can ever be relied upon to do this. Within the last ten years ways and means have finally been developed that prove that in the gyro compass alone, with its instantaneous response to minute deviations of course, we have everything that is necessary to accomplish the purposes most effectively, even including the easing off, meeting, and full anticipation.

Of course, in the case of the gyro compass it is not the master which is used direct. The repeater follows the master with an accuracy of one-twelfth of a degree. This minute accuracy of the gyro compass repeater gives opportunity for automatic steering never before possible.

The embodiment of the mechanism for automatic steering has been developed in two types, which may be known as the "separate" system and the "unit" system. In each case the steering wheel is in its ordinary position on the bridge. Either of these systems can be employed with any telemotor system, but the "separate" type is preferred where a telemotor is not employed.

Operation of the Automatic Quartermaster

The instrument is capable of being set for response to different amounts of deviation from course. It has been employed practically for continuous steering of very large ships, and its performance is illustrated by conditions where the response is set as close as ten minutes of arc or 1/6 degree of departure from true course in azimuth. This operation is positive in its nature and through the closing of an electric contact calls into action the rudder operating mechanism, which simultaneously establishes the helm angle. This, in turn, operates a suitable follow-up mechanism by adjustment auxiliaries effecting the proper anticipation, and the helm eased off and returned or swung to its proper complementary angle.

In a typical "unit" system the gyro compass repeater, located at the top of the pedestal containing the automatic mechanism, is provided with a handle which is used to throw the automatic device in and out of gear with the steering wheel. Near the top of the pedestal is located a small tiller wheel by means of which all changes of course are set. Adjustments are provided for steering with the least helm according to different conditions of the ship and weather. Any standard telemotor may be employed with either the "unit" or "separate" type equipment.

Discussion

R. H. Rogers, of the General Electric Company, outlined the operation of the "wake" type of automatic steering which is being developed by the General Electric Company. This system operates with a base line formed by means of a drag towed aft. As the ship tends to move from the direct line made with the drag, electric contacts bring motors into function which, through a suitable mechanism, act upon the tiller. In comparing the two systems, Mr. Rogers brought out the fact that the gyro system, by means of the compass, holds the ship's axis to some course that is manually adjusted by estimation from time to time so as to make good the desired course, while the "wake" system works solely to the course being made good as indicated by the wake and allows the ship's axis to take automatically whatever headings are necessary to prevent deviation.

The importance of an adequate system of automatic steering cannot be too greatly emphasized when it is understood that even at a small helm angle the rudder causes a tremendous drag on the propelling engines. When unnecessary deviations from course are prevented the saving in engine power is correspondingly great.

Commander Herbert S. Howard, C. C., U. S. N., stated that the Bureau of Construction and Repair of the Navy Department is very much interested in this matter of automatic steering and would especially appreciate information on one point: In any system such as Sperry's in which the effort to return a ship to its course depends upon absolute deviation from that course, it would seem that the steering gear would keep the rudder over until the ship had regained the intended course. Her head would then, due to inertia, keep swinging beyond this course, which at once would cause the steering gear to move the rudder to the other side. In other words, with this type of automatic steering it would seem that the ship would have a sinuous course, the steering gear constantly hunting to keep the ship on a proper mean course. Although the preceding seems the natural deduction from what is understood of the arrangement of automatic steering gear described the records of performance do not show such a result. I should like to ask whether any means for correcting such a hunting action of the steering gear was employed or whether any such means is considered necessary.

In explanation of this point, C. B. Mills, chief engineer of the Sperry Gyroscope Company, who read the paper because of Mr. Sperry's absence in Japan, stated that ships in which an automatic steering device has been installed are too large to deviate very greatly from the course on account of hunting action, the tendency to yaw being stopped almost immediately by the gear. A marked saving in fuel with the use of this equipment has been noted. Records of the *Munargo* since the device has been in operation were cited as an example of economies possible with this gear.

Details of Naval Design from Jutland

By Commander Herbert S. Howard (C. C.). U. S. N.

Abstract

The many reports and discussions that have been published on the Battle of Jutland almost invariably have to do either with controversial points of strategy, movements of fleets and so forth, or major questions of design, particularly those comparative between British and German ships such as protection of vitals, turret magazine protection and so on.

There is a field, however, which comprises the performance of the different detail features of design of the naval ships in the battle which has so far never been discussed.

Of the ships sunk in the battle the *Queen Mary, Indefatigable, Invincible, Defence, Black Prince, Weisbaden* and *Pommern* were sunk as a result of complete explosion resulting from a salvo reaching a vital spot, or from a torpedo. The *Elbing* and also the *Turbulent* were rammed and sunk by German battleships.

These losses are generally eliminated then as involving major questions of design. We have left, then, of the total losses, on the British side one armored cruiser and seven destroyers, and on the German one battle cruiser, three light cruisers and five destroyers.

Fire might be taken as the principal source of danger to fighting ships and those aboard them. It brings in questions of inflammability of materials, fire systems, pipe lines and the menace of magazine explosion.

Most of the fires on the ships that were destroyed were entirely cordite fires, shells exploding in the vicinity of ammunition brought up and held ready to serve the secondary battery of large ships or the main battery of light cruisers and destroyers.

On destroyers in general it would appear that one or two direct hits by large shells were enough to put the ship entirely out of commission. The same result followed from a few salvos from a light cruiser. Under these conditions fires broke out at once. On oil burning destroyers severe oil fires should have occurred. This, however, does not seem to have been the case. Of the six destroyers from which we have accounts, on two only were there apparently oil fires, which in both were overcome quickly and effectually.

The deduction from this is that fuel oil does not seem the menace to light ships that it has at times been considered.

In dealing with fires in action the most serious difficulty was apparently the fact that in many cases the shell explosion which caused the fire completely wrecked the fire main and hoses in the vicinity. Besides putting the local fire-fighting equipment out of commission, water from the broken fire mains poured out on the decks and down below into engine rooms and other spaces where holes in decks or hatches existed. As a suggestion, it would seem that shut-off valves with distant control gear, together with long emergency lengths of hose kept below protection, are necessary where fire-main risers pierce armor decks.

Summing up, the fire menace proved to be in general less serious than had been expected.

Outside of the main engines and boilers of a naval vessel, probably the most important item of her machinery is the steering gear.

Of the several steering-gear jams which occurred during the battle the only one of which we have the probable details is in the case of the *Warspite*. In that ship both steering engines were secured on a vertical bulkhead in the engine room, and, as far as could be told, the bulkhead was strained by the bursting of a shell in the vicinity. The result was to throw the engine out of line and cause it to labor and run hot. When the order was then given suddenly to put the helm over, the engine could not handle the sudden load and the jam followed. Of the mishaps on the *Invincible* and *Chester* we have no details, but it may be inferred that they were due entirely to excessive speed and sudden changes of course.

These accidents bring forward the great importance of the steering gear and primarily the fact that trial and test conditions are not those of trial alone, but the very conditions which will be met with and quite possibly surpassed in battle. To avoid similar mishaps in the future the gear must first of all be so located as to be as free from the surrounding structure as possible, so that damage to that structure may not be communicated to the foundations of the gear. Also in the design there must be no weak points, while the operation must be as simple as possible to prevent mistakes in connecting up or disconnecting in the excitement of battle. Finally and most important, the trial condition tests must be accepted as the ordinary working condition of battle.

The accounts of the battle bring up many interesting points to do with damage to turrets, and particularly their great powers of resistance against attack and their ability to keep going in spite of damage.

Of the records consulted, these show direct hits causing damage on turrets of the *Lion, Tiger, Malaya,* and three turrets of the *Derfflinger*. Many other direct hits on both turrets and barbettes of various ships were received without either penetration or damage, but the hits of interest to examine are those where damage was received. Of the battle cruisers blown up, some at least may have received their death blows through penetration of turrets or barbettes and explosions within.

For many years armor gratings have been fitted in the openings of armor decks of warships, and for many years ballistic tests of these gratings have been carried out at various proving grounds to test the resisting power against major shell impact, or the impact of smaller shells representing fragments. While these tests have been of great importance, they have never represented the grating in its actual service condition.

On the *Warspite* a 12-inch shell struck the armor grating over one boiler room, but did not penetrate and was deflected upwards. The gratings were bent, but none broken, and apparently did all the work intended. Subsequently it was found that two other heavy hits had been received direct on the gratings, but in each case the shell was deflected. These reports indicate most clearly that reliance may be placed upon well-designed armor gratings.

After the battle the splinter nets below the gratings were found full of fragments, which confirms the opinion held as to the necessity for some additional protection below those gratings which receive the direct impact.

Rather an extraordinary thing occurred on the *Derfflinger*. In the middle of the battle the main central or plotting room suddenly filled with gas and had to be abandoned. It was found that the gas from the powder fires in the after turrets, and probably also from the ship's own guns, and from shells exploding aboard, had passed down the voice tubes to the central and temporarily put the station out of commission.

There was clearly shown here the danger from gas penetration through voice tubes, and in fact through any form of communication between compartments through which gases may pass.

Torpedo nets had been used both by English and Germans for many years before this battle, the former having, it is believed, been the first of all navies to introduce their use. As far as is known, the British removed them from their ships before Jutland. The Germans, however, went into battle with the nets on board stowed brailed up against the side in sea position.

After the battle Admiral Scheer stated that the nets on most of the ships were so damaged that it was impossible to remove them. In many cases they hung down in festoons, so that it was a wonder the propellers were not entangled.

It has been realized for some time that nets could be of service only to ships at anchor or at the slowest speed. Now we have it most clearly shown that they may become a grave menace to ships in battle. It would seem, then, that the case against the torpedo nets is complete.

Discussion

In a written discussion of this paper Professor William Hovgaard, of the Massachusetts Institute of Technology, offered as suggestions additional matters of detail naval design which might be studied and reported upon from the records of the battle of Jutland. The behavior of ships under the stress of war service, their suitability for the particular duty to which they are assigned, the damage which they suffer in action and their behavior under various forms of attack—all these points should be carefully studied and an attempt made to draw conclusions which may be useful in the design of new ships. The emphasis which the author of the paper lays on the importance of a robust and reliable steering gear as well as on its effective protection is most timely. The matter of danger from fires due to the ignition of powder charges is a point to which designers should give the most careful study. On other points not referred to in the paper it is safe to draw conclusions: During the war numerous cases occurred where towing of disabled warships was necessary, in some cases the life of the ships depending on the success of the operation. Adequate appliances for the efficient towing of large vessels should be supplied and the personnel trained in their use.

The importance of being able to stop leaks promptly and effectively in action was hardly realized prior to the war but improved appliances suitable for this should be provided and the service pertaining to their use carefully organized.

Most of the warships that went down during the war cap-

sized before they sank. To prevent or delay the process of capsizing and in general to right a ship quickly when she takes a list is of the greatest importance. Powerful means for righting the ship should be installed.

The serious consequences of salt water entering the feed tanks were demonstrated during the war. Feed water tanks should be so placed as to give them the best protection.

Rear Admiral A. P. Niblack, U. S. N., in discussing the fire hazard on board naval vessels in action, indicated that after practically every important naval engagement since the inception of the modern navies the question of fire on painted surfaces has been discussed. The present paper brings out very well the greatest points in fire hazard which are due mainly to cordite and other ammunition fires. In exhaustive tests by the Navy Department it has been impossible to ignite paint on steel surfaces, so this matter has finally been settled to the satisfaction of the constructors. Gases on board ship from shell explosions offer a very serious menace which must be guarded against by proper ventilation, the use of gas masks suitable for absorbing carbon monoxide and other means of protection. A great deal on the matter of ventilation is to be learned from the battle of Jutland. Since torpedo nets have never been used aboard ships of the United States Navy it is interesting to know that the decision of the Department not to equip our ships with them is borne out by the experience of the German ships during the battle of Jutland. One matter which should be investigated, for which practically no data are available, is the extent to which water coming aboard from shell explosions or other causes affects the fire control and other optical instruments of observation.

Commander Emory S. Land, C. C., U. S. N., suggested additional details of design to be studied, including watertight doors; flooding systems; drainage systems; communication systems, voice pipes, telephones and the like. Construction and operation of special equipment should be considered of equal importance; that is, when it is thought desirable to install equipment for special purposes on a vessel, such equipment should be used and the personnel trained in its operation.

Admiral D. W. Taylor, U. S. N., stated that during the battle both the offensive and defensive apparatus with which the ships were equipped functioned correctly and well. The question of fire hazard is probably the most important matter to be guarded against, cordite fires and apparatus for fighting them being the principal considerations under this head. Provisions should be made to protect the personnel against poison gases from shell explosions or other causes. The matter of torpedo nets was finally settled as a result of the German experience with them in the battle.

Stresses on Vessels of the Great Lakes Due to Waves of Varying Lengths and Heights

By Professor Herbert C. Sadler and Professor A. Lindblad

Abstract

At the last meeting of the committee on bulkheads and freeboard the question of including vessels on the Great Lakes in the assigning of freeboard came up. As no systematic investigation of the strength of this type of vessel had previously been made, it became necessary to carry out several strength calculations for the conditions met with in this region.

The study of waves encountered led to the conclusion that they seldom ran over 250 feet in length and that their heights appeared to be somewhat larger in proportion to their length than the usual ratio of 1:20.

Calculations were made for waves having the above characteristics on three types of vessels varying in length from 420 feet to 590 feet. The results are summarized in the form of bending moment factors and these will be included in the complete report to be published later in Marine Engineering and Shipping Age.

The conclusion drawn from the tests is that the lake freighters of today are for their service as strong as, if not stronger than, similar ocean-going types.

Discussion

In a written discussion on this subject David Arnott, deputy chief surveyor of the American Bureau of Shipping, brought out the fact that in the design of any ship's structure it is desirable, if undue waste in material is to be avoided, not only to know the maximum load to be carried but the most trying conditions as to distribution of load and the kind of seas likely to be met with in the service for which a vessel is intended. It is of importance that the authors have included in the paper data on waves encountered on the Great Lakes and the assertion that a wave of 350 feet in length and 20 feet high is the worst that need be considered. The large single deck bulk freighters used on the Great Lakes are a product of design to meet special conditions, the aim being to get the maximum deadweight on a restricted breadth and draft. The proportion of length to breadth given in the paper for a 580-foot vessel is considerably in excess of any merchant vessel engaged in overseas service. The big lake freighters are well designed for their intended service; that is, the carriage of ore, coal and grain on the Great Lakes. The longitudinal structural strength could be improved by carrying the wing tanks to the deck but this would reduce the deadweight carrying capacity for grain cargoes. One consideration which should not be lost sight of in making strength comparisons is the absence of serious deterioration through corrosive action in the steel hulls of lake vessels and, although a margin for corrosion is not evident in the strength standard of ocean-going vessels, it is there nevertheless so that on this ground alone lake vessels could have lighter scantlings and lower initial strength standard.

Admiral D. W. Taylor, U. S. N., in his discussion also mentioned the fact that the wave data on the Great Lakes gathered for this paper are very valuable. The fact is mentioned that the waves encountered are steeper than those of ocean waves but the depth of water actually is not the cause of this condition. The length of a wave seems to determine its steepness. The shorter ocean waves are, the steeper they become and this same fact would be true for waves on the Great Lakes which are comparatively short.

WEDNESDAY AFTERNOON SESSION

No important routine business came up at the opening of this session, the reading of papers being continued directly. The order of papers was somewhat changed in the morning session so that the following paper, which was originally scheduled for Wednesday morning, was read the first thing in the afternoon.

The Application of Dyson's Method to Propellers of Ocean-Going Merchant Vessels

By E. A. Stevens, Jr.

Abstract

In 1920 Admiral C. W. Dyson presented a paper on "The Problem of the Hull and Its Screw Propeller," in which a number of examples were given. As these were all naval vessels the writer has attempted to apply Dyson's method to

merchant vessel types and to compare the results with trial results on these vessels.

The problems may be divided into three groups. (1) Single screw vessels. (2) Vessels fitted with two or more screws—wing screws and struts. (3) Vessels with two or more screws—wing screws and bosses. Complete results of the comparisons will be published in detail in a later issue of MARINE ENGINEERING AND SHIPPING AGE. Seven are single screw ships, all of which with one exception have full lines, the block coefficients being over 0.77. Three are steel twin screw cargo and passenger ships or freighters. One is a moderate speed cargo and passenger vessel and the remaining two are high speed passenger vessels.

It is impossible to draw a general conclusion that will apply to all of these types of the comparative results obtained by Dyson's method of the actual trials as the complete tabular data contained in the paper must be studied for each individual case.

DISCUSSION

W. W. Smith, chief engineer of the Federal Shipbuilding Company, has found that because of the widely varying sea conditions encountered the 20 to 30 percent which the author adds to the ideal effective horsepower to obtain the effective horsepower at sea is a good allowance. No method of estimating, however, can predict the performance very closely for all conditions. The author is justified in his conclusion that the Dyson method is accurate for merchant type vessels, the trial results checking very closely with the estimated performance. Some of the differences noted are no doubt due to errors in measurement and the like. The analysis proved the reliability and accuracy of the Dyson method and so far as is known it is the only completely developed method for designing and analyzing propeller performance. Also it is the only one where the estimated performance checks closely with the trial results and where size, speed and cavitation are fully provided for.

In a written discussion Admiral Dyson brings out various points of difference with the author. He outlines the effect of spectacle frames and of the fin along the bottom of the ship when it is horizontal and at an angle with the hull. When the fin is horizontal or nearly so the basic slip of the hull is very much decreased from that which would exist when struts are used instead of spectacles. Also the K factor is reduced so that the new K factor equals the normal K factor of the hull of the one-seventh power. Where the fin is so located as to have no directive force upon water flowing to the screw, or to interfere with the water closing in around the hull, its effect on the basic slip and on K is nil. He goes on to discuss the conditions of the type 2 ship mentioned in the paper. When this ship is loaded down very deeply her estimated revolutions are considerably below those actually obtained. In such ships it is found better to make no correction as the ship is loaded down but to use for H the height from the base line to the upper limit of the stream line body Any increase in block above this has no effect on the revolutions but it does effect the value of K.

A Study of the Wake of Certain Models by Means of a Current Meter

By Professor E. M. Bragg

ABSTRACT

BY means of a current meter fitted with model propellers of varying diameters certain results of the effect of wake on models have been derived in this paper.

Tests were made on a 10-foot varnished plane for a series of four wax models with constant length of entrance and varying length of run, for a series of five wax models with constant length of run and varying length of entrance and for six wax models with no family relation. The speeds at which the tests were made ranged from about 140 feet per minute to 250 feet per minute. In the fine models the wake showed a slight tendency to decrease as the speed increased, while in the full models the wake was constant up to 200 feet per minute but at higher speeds there was found a marked increase in the wake due probably to the position of the stern wave.

This study of the wake of models, while not extensive enough to be conclusive, indicates that any complete system for determining wake values must include the following conditions: (1) The diameter of the screw relative to the draft of the ship. (2) The draft of the ship relative to the breadth of the ship. (3) The fore and aft position of the screw. (4) The transverse position of the screw. (5) The vertical position of the screw relative to the keel. (6) The vertical prismatic coefficient of the ship.

Some Experiments on Propeller Position and Propulsive Efficiency

By Rear Admiral D. W. Taylor, C. C., U. S. N.

This paper is published on page 785 of this issue.

DISCUSSION

W. W. Smith, chief engineer of the Federal Shipbuilding Company, had prepared written discussion on each of these papers which he read. In discussing the paper on "A Study of Wake," he stated that the paper was valuable for estimating the wake factor but for estimating propeller performance two other hull coefficients are required—the hull efficiency and the rotative efficiency. In making propeller estimates some engineers assume the hull and rotative efficiencies to be unity, but this assumption may introduce considerable errors in certain cases. The following elements would seem to require consideration in determining the hull coefficients of a vessel: Proportion and form of afterbody, size and location of propeller, and numerous others, including struts and bossings, cutting away of deadwood, rake of shafting, trim of vessel, location of rudder behind screw, speed length ratio and the like. Because of the large number of features involved it does not seem feasible to treat their application in an elementary form, it appearing more practical to divide all vessels into six or eight main groups, preparing for each group suitable data and coefficients for all practical variations. Referring to tests at various drafts it would be of value if the author would give prismatic coefficients of the afterbody for each draft. This paper emphasizes the difficulty of making estimates accurately from general data and the importance of self-propulsion tests which represent exactly the conditions to be met with. Further self-propelled model tests will not be truly valuable until they are proved reliable, and this will not be true until a number of test and trial results are compared, coordinated and published.

In speaking of the paper on "Propeller Experiments," Mr. Smith declared that he had sought after reliable data for estimating the effect of speed on the performance of propellers but had found none which seemed reliable except the charts given by Admiral Dyson, which data are only applicable where Dyson's method of estimating propellers is used. It would be desirable to have similar data for estimating full size propellers from model experiments. The large increase in hull efficiency brought out in the information contained in the paper, due to raising the propeller, is extraordinary, the gain in efficiency varying from 8 percent to 32 percent, with an average of 16 percent. The author's statement that a high location of propellers is desirable be-

cause of improved efficiency is contrary to the general idea that the lowest position is the most efficient. Admiral Dyson, for instance, gives an example in his book where lowering the propeller improves the efficiency greatly.

Mr. Smith ran tests on a small freighter driven by a Diesel engine to compare the propulsive efficiencies for high and low positions of the propeller and presents his findings in tabular form. In two cases a higher propulsive efficiency is obtained with the wheel in a lower position. This result, he states, is due to the higher slip ratio which occurs when the wheel is in the higher position; the higher slip ratio gives a lower propeller efficiency; also the pitch for the higher position must be less, which augments this effect.

Professor L. B. Chapman, of Lehigh University, in discussing the two papers together stated that when our knowledge of wake and the factors governing it has been carried a little further, propeller design will become simpler and more certain. From a large number of comparisons made between trials and the calculated results in Taylor's "Delta" diagrams when the wake could be closely estimated the check has been close indeed. The use of Taylor's charts is much simpler than any other methods and when proper wakes, thrust deductions and hull efficiencies are used the results are even more accurate.

Professor Bragg's suggestion of using a vertical prismatic coefficient is interesting, but the longitudinal coefficient (prismatic) of the afterbody is one of the most important factors. Difference in wake values between two of Professor Bragg's methods can hardly be charged to the difference in beam draft ratio. A comparison of these two methods on the same block coefficient and percentage of run shows a variation in wake of about 20 percent which is hard to explain.

THURSDAY MORNING SESSION

The second day's sessions of the thirtieth annual convention of the Society of Naval Architects and Maiine Engineers was opened by President McFarland at 10:30 A. M. November 8 in the Auditorium at the Marine Exposition. The great interest that was shown by the members in the first day's work was continued, even more being present than at the first sessions. No routine work was taken up at this point of the meeting.

Efficiency in the Operation of Steamships

By Captain Daniel A. J. Sullivan

This paper will be published in a later issue.

Discussion

In his remarks C. D. Mallory said that the salient features of ship operation had been covered very aptly in the paper by Captain Sullivan. Mr. Mallory's experience had been gained in the coastwise trade until 1917, after which time he was in charge of the Division of Operations of the Shipping Board until the end of the war. Since then he has been associated in operating twenty-three vessels on an intensive plan with a man who has had an extensive experience in foreign countries. He has come to the conclusion from intimate contact with foreign methods that with the high values in American ships and the correspondingly great interest and depreciation it is difficult for us to compete with other countries. Fuel, which is the biggest item of expense, by a proper study and application of efficiency in its use, will make competition easier. Oil for fuel is cheaper in this country than anywhere abroad. The United States Navy has learned more about its efficient use than any other navy in the world, and the Shipping Board is now making available this information to ship operators and engineers in the establishment of the naval school at Philadelphia. It is difficult to compare Shipping Board figures of operating costs with those of privately conducted concerns, since the latter are given a much wider latitude than in the case of the Shipping Board or ships allocated by the Shipping Board to private operators. The cost in general is higher for a Shipping Board vessel than for one privately operated.

James Donald seemed to think that the only proper way to compare operating conditions in this country with the ships of foreign countries was to prepare tables covering the same information as that given in the present paper. When the increased cost of wages in this country is included with items of first cost, depreciation and other high operating costs, little chance is left for American ships in competition with those of other powers.

Referring to the point made above, John L. Bogert presented a chart covering the items of the cost of operation of a fleet of one of the most successful foreign companies for a period of five years prior to the war. He particularly emphasized the item of fuel cost, which was given as 21.34 percent of the whole in 1911, when the fleet was composed mainly of steam driven vessels. At the end of five years, when practically all of the fleet consisted of motorships, the fuel cost had dropped to 16.58 percent. As in the case of railroads, ship operating costs must be reduced to the basis of cost per ton-mile. This matter has been taken up very satisfactorily on the lakes and can be applied to ships in the Atlantic trade. Comparisons on this basis could be made between all kinds of ships in a variety of service. Such a comparison could be established on a basis of Admiralty coefficients. Bearing out this statement, Mr. Bogert presented the comparison between a 370-foot ship and a 580-foot ship. In the former, 8 pounds of coal were consumed per 100-ton miles, while in the latter only 4.4 pounds of coal were consumed per 100-ton miles, making evident the fact that as the length of the ship goes up the fuel cost decreases quite rapidly.

Another contributor to the discussion familiar with the wage scales of Norway and Britain as well as with that of the United States, felt that other methods of reducing the cost of operation could be utilized without interfering with this item, which is not the most important. Efficient stevedoring, more rapid turn around, speedier loading, reduction of time at port and other items would contribute very greatly to the improvement in efficiency. The legislation governing tonnage dues, port charges, better contracts for towage and tug hire will aid in putting our ships on a competitive basis with those of other countries. From his experience with the carriage of oil this gentleman stated that, if a practical heating unit for liquefying the oil cargoes, especially crude oil, could be evolved, the motorship would solve many of the carrying problems of the oil companies.

E. H. Rigg, naval architect, New York Shipbuilding Corporation, referring to the cost of operation of vessels on the Great Lakes, brought out the point that lake vessels operate only during the summer months when the weather is good. A real comparison can hardly be made with ocean-going vessels, which must be used all the year around, in bad weather as well as good. Ships handicapped in this country by the high first cost will find it difficult to compete with more cheaply built foreign ships.

Professor Evers Burtner, of the Massachusetts Institute of Technology, in a written discussion offered a suggestion which has been found valuable by certain ship operating companies that a semi-graphical log sheet be used in maintaining records which act as a check and follow-up system to prevent unavoidable delays in turn round and the like. A summary is given in a sheet of this nature for the time required for different operations such as the time at port, time consumed at sea, demurrage repairs, speed in handling cargoes and the like.

G. E. Smith stated that since fuel and cargo handling

costs represent about 50 percent of operating costs, it is better to promote efficiency in the use of the former and improve the methods of handling cargoes than to interfere with the smaller item—wages. A custom in this country which increases construction costs materially is for the prospective ship buyer to specify very largely exactly what type of ship and equipment he will accept. In foreign countries the constructor uses his judgment in these matters and gives the operator a satisfactory ship for the purpose desired but without the many refinements and special features included in ships built in this country.

A 1,650 Horsepower Gasoline Fire Boat

By A. D. Stevens

Abstract

A DOZEN or more years ago the writer endeavored to develop a gasoline fire boat for the 7 odd miles of waterfront at Jacksonville. The boat was to have about 4,500 gallons per minute capacity, which could have been built at that period for less than $50,000. The use of gasoline on so large a scale did not appeal to the fire department at that time.

Four years ago, after the department had been converted to automobile trucks and motor fire engines, the fire-boat project was revived and the design of motor fire boat brought up to date.

The writer then submitted designs and specifications for the remodeling and conversion of *S. C. 145*, the boat the city had bought, which were accepted and ordered carried out under his directions as engineer in charge.

As a capacity of not less than 5,000 gallons per minute at 150 pounds pressure was desired and it was necessary to retain two of the three 220-horsepower propelling motors, it will be seen that there was no room to spare in a light wooden hull 110 feet by 14 feet by 8 feet.

In the forward 30 feet there are installed four 8-inch three-stage De Laval centrifugal fire pumps, each directly connected to a 300-horsepower "G. R. C." type Sterling eight-cylinder motor.

Since there are in the 50 feet by 14 feet machinery space forty-six gasoline motor cylinders aggregating 1,650 horsepower, the question of ventilation is of prime importance. This is provided for by two 2,000-cubic-foot-per-minute electric blowers, taking air through the after end of the steel trunk house and delivering it through ducts abreast of each propelling and pump engine.

In the 20-foot space used for the propelling machinery are two 220-horsepower six-cylinder air starting and reversing "Standard" motors, each driving a 48-inch diameter by 42-inch pitch three-bladed wheel of "Case" outward thrust pattern.

While the contract specifications of the pumping units called for a delivery (for each unit) of 1,250 gallons per minute at 150 pounds pressure and 1,100 gallons at 250 pounds, the tests at the builders' factory showed nearly 1,500 gallons at the lower pressure and 1,200 gallons at the higher. Tests at lower pressure gave a capacity of 1,750 gallons at 100 pounds, making a total of 7,000 gallons for the four pumps.

A special feature of this pump installation is that no compounding of the pumps is required to deliver the high pressure—250 pounds. The entire range of pressures is obtained by varying the speed of the engines.

Preliminary runs have developed a speed of 15 miles, with engines making 450 turns.

Summing up, the city of Jacksonville has secured, at a cost of less than $70,000, a fire boat of 7,000 gallons per minute capacity and a speed of 15 miles per hour, with a displacement of only 110 tons and a draft of 7 feet.

The Longitudinal Strength of Rigid Airships

By Professor William Hovgaard

Abstract

THE general strength of rigid airships is a problem akin to the corresponding one for ordinary ships. This paper results from a study of the subject carried out by the author when retained by the Navy Department in connection with the design of the rigid airship *ZR-1*.

The main purpose of the paper is to show that of two methods of calculation developed the bending method is essentially sound, and that with certain modifications it is reliable as a means of comparison between the strength of different airships. The shear method, on the other hand, in spite of its laboriousness, is incomplete and gives the correct results only when the longitudinals are at the apices of a regular polygon and when at the same time they are of uniform strength.

The study of the complex reactions in an airship is built up synthetically from a number of simple cases, beginning with rectangular panels. Following the study of the panel the theoretical effects of shearing and bending in the structure of an airship of regular polygonal section are examined and the conclusions are applied to an actual ship.

In conclusion the author states that:

1. A wire, so long as it is in tension, will transmit compressive forces as effectively as an elastic strut.

2. A wire may transmit tension and compression without any sensible change in its tensile stress.

3. The tension in the shear wire when a panel forms part of an airship structure is the sum or difference of that due to shearing deflection and that due to the direct pull or compression acting at the joints.

4. The horizontal forces, whether tensile or compressive, acting at a joint of a panel are directed partly along the longitudinal and partly along the wire (or wires) which meet at the joint, provided the wire is not slack.

5. The aggregate effect of a longitudinal and adjoining wires is the same as that of a girder of an area equal to the sum of that of the longitudinal and of the fictitious bars equivalent to the wires meeting at the joint.

6. Initial tension in the wires prevents or greatly reduces slackness and enables the counterwires to act as effective strength members.

7. The bending method can be safely applied with a fair degree of approximation to airships.

8. In applying the bending method to an actual airship, it is recommended to deal independently with each frame section.

9. The method of shears is fundamentally in error when used as the sole means of determining the general stresses in the structure of an airship by a process of summation.

Discussion

Commander Emory S. Land, C. C., U. S. N., Bureau of Aeronautics, presented a discussion on this paper prepared by Commander Jerome C. Hunsaker, C. C., U. S. N., Bureau of Aeronautics. In his own remarks prefacing the reading of this paper Commander Land stated that the *Z-R2* disaster, which occurred during the past year, developed the necessity for a more complete understanding of the stresses occurring in the structure of airships. Reports published in the press at the time of the disaster and subsequent to it seemed to indicate that the longitudinal strength of the keel member of the ship was insufficient, eye witnesses reporting that she seemed to open along the bottom. As a matter of fact, this statement was in error as the side members of the structure gave way first, the question being unimportant as to whether the top members or the keel failed after this.

In designs up to this time, the static forces on a ship were considered the important ones and it was thought that the allowances made for strength and the factors of safety incorporated in the design would take care of the aerodynamic forces. Investigation and the disasters noted in the past few months indicate that the aerodynamic forces under certain conditions may be even greater than the static forces and, as such, must be provided for in the original design of the strength members of the structure. The solution of problems in design are extremely difficult since they must take into account shearing, compression, tension and torsion forces.

The analogy made between the airship and the submarine is excellent and those who have aided in the solution of the problems encountered in the design of the latter should interest themselves and make available the results of their investigations in solving the airship problem.

The study of the stresses in rectangular panels, developed in the paper, forms an excellent basis for calculations. However, the actual problem is much more complicated where panels are bonded together, as in the airship structure.

Another point that must be considered in the investigation of actual ships is the fact that materials are more or less concentrated in weight at certain points, which is noticeably so at the keel. There is still a tremendous amount of work to be done in the laboratory, air tunnels, model basin and in the air on actual ships before the problem is completed.

Henry Goldmark, chairman of the committee of five on the investigation of the *Z-R2*, contributed valuable suggestions for the continuation of the work of investigating the subject and outlined the necessity of solving the problem of the forces acting on the ship, which are three-fold, the weight of the structure, the gas buoyancy and gas pressure and the aerodynamic forces which occur when the ship is being maneuvered. The theory of longitudinal strength is developed on the basis of beam action but the number of parts is so great that the method of least work is not usable. Approximate methods must be employed and checked so far as possible in model tests, theoretically, and finally checked by actual tests on ships.

Captain William J. Baxter, C. C., U. S. N., and Lieut.-Commander Harold E. Saunders, C. C., U. S. N., also contributed to the discussion of this paper.

Amendments to Constitution Adopted

For some years past several objectionable features have existed in the method of electing members to the Council of the society. The trouble has been carefully investigated by the officers of the society in the hope that the difficulties could be removed with the result that before the meetings this year the Council formulated changes to the constitution which were passed by the members at the Thursday meeting.

The wording of several sections of the constitution was changed but, as the meaning remains the same, these sections will not be included here. Those in which the revisions have altered the intent of the original sections are given below.

The principal provisions changed deal with membership of the Council and now read as follows:

ARTICLE IV—To read as follows:

1. *There shall be a Council composed of eighteen Members and nine Associates; and the President, Past Presidents, Honorary Vice-Presidents and Vice-Presidents shall also be Ex-Officio Council Members.*

2. The council *shall* meet at the call of the President *just prior to the annual general meeting of the Society and at such other times* as the interests of the Society may demand.

3. At all meetings of the Council *eight* members *thereof* shall constitute a quorum.

4. The term of office of Council Members shall be three years.

5. (a) *Prior to September First of each year the Executive Committee shall prepare ballots for filling the places of the Retiring Council Members.* The ballots shall contain the names of six *Members and three Associates of the Society* and shall be mailed as soon as practicable after September first of each year to all Members and Associates.

ARTICLE IV—Section 5, (b) to read:

(b) An independent nomination for Council Members may be made in writing by not less than thirty Members and Associates, of which number at least two-thirds must be Members; and if such nomination is received by the Secretary prior to September fifteenth, ballots shall then be prepared by him containing the names of those thus nominated and these ballots shall also be mailed to the membership.

(c) Each member may vote for not more than six Members and three Associates, and each Associate may vote for not more than three Associates to be Council Members.

The ballots shall be returned to the Secretary and canvassed by *the Council* at its meeting just prior to the annual general meeting of the Society; and the six Members of the Society and three Associates receiving the highest number of votes shall be declared elected Council Members.

(d) A vacancy in the office of Council *Member* shall be filled by the Council for the unexpired term.

As indicated, the provisions of Article IV, Section 5, allow for the election of exactly the number of individuals to the Council whose names appear on the ballot, thus avoiding the necessity of having the names of interested, active members of the society proposed on the ballot and then having these individuals eliminated in the election.

As noted above, the other changes in the constitution that were adopted are mainly in the wording, so that it does not seem necessary to include them in the report.

THURSDAY AFTERNOON SESSION

Colonel E. A. Simmons, president of the American Marine Association, was presented at the opening of the afternoon session by President McFarland. In his remarks Colonel Simmons cordially invited the naval architects to hold the professional meetings of the society in 1923 in conjunction with the exposition during Marine Week.

Following this, action was taken on ten names which had been proposed for election to the grade of member. Two associates were elected, one associate transferred to the grade of member and one junior to the grade of associate member.

Machinery and Trials of the Passenger Ships—American Legion Class

By Robert Warriner

Abstract

This paper gives the results of a model with rudder pulled in the tank at Washington, D. C., a self-propelled model run in the same tank, and a fairly good standardization trial of the completed ship at a draft corresponding to one of those at which the models were tested.

The vessels of the *American Legion* class are of the shelter-deck type, with straight stem and cruiser stern. The framing is constructed on the longitudinal system, except at the bossing and at the ends. The shell plating is arranged with in and out strakes, with overlap butts below the water line. The principal dimensions are: Length overall, 535 feet; breadth molded, 72 feet; designed load draft from base line, 30 feet; corresponding displacement (tons), 20,980.

The two propeller shafts are supported by cast steel spectacle frames and the framing and plating of the ship are bossed out from where the stern tube interesects the hull to the point where it attaches to the spectacle frame. The keel is of the flat type and the rudder balanced, with double steel plates over cast steel frame.

The engines are designed for 12,000 shaft horsepower on two shafts, and each shaft is driven by compound turbines through single-reduction gear with two pinions and main gear wheel in a single plane.

The screw propellers are of bronze, and are solid, three-bladed, 16 feet 6 inches diameter, 17 feet pitch, and each has 80.7 square feet of developed surface and 69.4 square feet of projected surface.

The lubricating oil is arranged on the gravity system with two pumps, two coolers and one gravity tank to each engine.

There is one V-shaped condenser to each engine with built steel shell, rolled brass tube plates and cast iron water ends.

The boiler installation consists of eight watertube boilers of the Yarrow type, arranged in two boiler rooms. The total heating surface in the eight boilers is 40,000 square feet. The boilers are oil fired, using mechanical burners and closed stokeholes.

The model for the vessels of this class was towed in the tank at Washington, D. C., under various conditions. The curves estimated from the tests show the shaft horsepower, revolutions per minute, and propulsive efficiency at 24 feet, 30 feet, and 36 feet draft.

The sea trials of the *President Pierce* were carried out at 24 feet draft, the lowest at which the models were tested and the easiest at which to ballast the ship, with the loads arranged so that at the high runs of the standardization trial, the draft would be as near as possible to the 24 feet and as near as possible to an even keel.

The plates given with the paper show the comparison of the model tests with the actual trial.

DISCUSSION

C. F. Bailey, engineering director, Newport News Shipbuilding and Dry Dock Company, gave an outline of the machinery details of the two *American Legion* class ships built by the Newport News Company which were somewhat different than those of similar ships built at other plants. For example, the main condensers on these two ships, the *President Cleveland* and the *President Jackson*, were reconstructed from condensers supplied by the Shipping Board. He went on to outline the full power trials of these two ships, the fuel consumption and the like, and to compare the results with the results given in the paper. He raised the question of the ability of the reduction gears to stand up under the continual overload to which they are being subjected in service.

E. H. Rigg, naval architect of the New York Shipbuilding Company, brought up the question of the discrepancy noted in the paper between the expected and the realized power. Several points of difference existed between the models and the ship as well as some differences between the propellers which no doubt would account for some of the error. The depth of water on the course can hardly be considered responsible because below 15 knots the effect of depth is hardly appreciable. The torsion meters used on the models may have read high as certain reports recently made would indicate.

Admiral C. W. Dyson, U. S. N., also noted the large discrepancy between the model basin trials and the actual trials of the vessel. The character of the hull, interference due to fins extending aft to the braces, and the like, probably had an influence on the matter.

Alfred J. C. Robertson, naval architect, Munson Steamship Line, gave details of operating results of the *American Legion* class ships in service. It is difficult, however, to eliminate actual conditions encountered in service that influence the operation of a ship so that comparisons may be made with trial or model test results.

Admiral D. W. Taylor, U. S. N., stated that this was not the first time that model basin results, when compared with full scale trials, have shown discrepancies. The fact, however, that the error reaches 12½ percent at 19 knots and 15 percent at lower speeds should be investigated. It has been found on exhaustive tests with naval vessels of all types that at speeds below 15 knots the depth of water on the course does not influence the run appreciably so that this factor can be disregarded in attempting to account for the great discrepancy noted in the paper. The question of fouling of the bottom might have a slight influence, the change of propeller speed on one vessel—the *President Pierce*—might have an effect; character of the hull, as brought out by Admiral Dyson, probably all influence the final result, the error being made up of small causes.

C. F. Bailey stated that it would be interesting to have data from the operators on the fireroom temperatures and the statement of the ability of the gears to stand up under heavy overloads which they are receiving in service.

Standardization as Affecting the Shipbuilding Industry in the United States

By E. H. Rigg

This paper is published on page 749 of this issue.

DISCUSSION

Hugo P. Frear, naval architect, Bethlehem Shipbuilding Corporation, Ltd., brought out the fact that the real standardized ship was one that could be built by several yards and which would be exactly similar in detail. If an individual builder in filling repeat orders could supply exactly the same type ship to the ship operator, such a ship would also be considered standard. During and immediately after the war, ships that may be considered standard were built in numbers at various plants but the chances are that occasion will never again arise when the necessity will exist for building ships in exactly the same way. It is hardly practicable to extend standardization beyond fittings and details in design and these considerations are not disregarded in this country. Shipbuilders and manufacturers develop standards of their own. The problem seems to be one of simplification rather than standardization. In his experience on standardization committees, a great deal of time and effort has been spent on standardizing the simplest fittings. However exhaustive the work will be, a start should be made. After standards are adopted shipbuilders and owners should follow them and give their support to the movement.

Professor William Hovgaard, Massachusetts Institute of Technology, stated that standardization can be carried to excess. The system should be elastic to take care of improvements. In Germany at the present time industries in general, including shipbuilding, are being subjected to the principles of standardization. Lists of standard fittings, machinery practices and the like are being published in technical journals from time to time outlining the progress of the work. The standards adopted are subject to modification as investigation and experience warrant changes. Once equipment is standardized, however, it should be used until it has been economically successful.

H. G. Smith did not feel that standardization would be carried too far. The two sections of ship standardization, as indicated in the paper, are the standardization of ship types and the standardization of parts. For the former, except in the event of war, the requirements for ships do not warrant quantity production. In the Navy, the standardization of parts, such as hatches, watertight doors, air ports and the like has been established, but when these standards have been submitted to the shipyards and put in effect improvements have made them practically of no use after a short time. He cited the example of a Chicago plant which was established for the manufacture of standard ship fittings. Jigs, fixtures and machinery were developed at great expense to turn out really excellent equipment but within a few months and before the original cost of the equipment had been returned from the products manufactured the

standards had changed so that the entire machinery and other equipment had to be discarded. The company failed on account of the lack of sufficient orders. This brings out the point that when standards are adopted they should be retained for a sufficient length of time to at least cover the cost of establishing the necessary production equipment and organization. In other words, changes in standards should be made slowly.

Admiral A. P. Niblack, U.S.N., in his remarks indicated that standardization is almost entirely an American accomplishment. The British, however, have done a great deal in this connection in shipbuilding. The standard design of the torpedo boat destroyers adopted by the U. S. Navy is one of the greatest examples of standardization on record. With the exception of machinery and slight changes of construction in the engine and boiler spaces, everything on all the destroyers is the same. Very few individuals realize the work which has been done in standardizing machinery and machine supplies at the naval experimental station, Annapolis, Md. The Navy will supply any of its facilities and information on the subject to aid the shipbuilders in trying to arrive at suitable standards. A lot of money can be saved in the industry by using standard fittings that are available on the open market rather than attempting to make them in the shipyards.

H. H. Schulze, of the Bethlehem Shipbuilding Corporation, Ltd., stated that standardization in shipbuilding would only become effective when the shipowner was willing to accept the standards developed by the shipbuilder. Shipowners, particularly large buyers, have their own standards which render the standards of the shipbuilder useless and consequently entail an additional cost for construction. When, however, the owner's requirements are not specified, standardization either of individual items, groups of items or methods of construction are of the greatest value. Nearly all old line shipbuilding companies have adopted standardization of items such as flanges, fittings, shackles, etc., but few have attempted the standardization of an entire system such as anchor gear, boat gear, rigging and the like. Where such entire groups have been standardized, they are of great assistance in the preparation of bids for the reason that without investigation on the part of the estimator he has immediately at hand the results, including weight and cost, of the best practice. Even steam engineering piping, complicated as it is, can be standardized to meet practically all conditions.

Selection of the Best Kind of Propelling Machinery

By J. L. Ackerson

Abstract

NEVER before has the marine engineering fraternity had so many different types of propelling machinery to select from, and there is no empirical formula which can be applied to help select the best type. Among the many factors to be considered are reliability (this is the most important single factor, for without reliability other advantages are very much discounted); economy in operation, initial cost, and weight.

The factors controlling reliability emanate from two different sources: (1) the owner through the selecting of competent personnel; and (2) the builder. No matter how well a machine has been designed and constructed, if placed in the hands of an incompetent operator it will become unreliable; and *vice versa*, no matter how good the operating engineer, if the proper factors have not been used in the design and care in the construction, then the machinery is again unreliable.

Economy in operation (that is, the fuel per horsepower) and initial cost usually bear a very close relation to each other, and it is only a question of figures to determine whether any particular type is worth the money as compared with any other type.

Weight is the least important except in the case of special types like shallow-draft boats, express-type steamers, warships, etc., because it is seldom that a ship is loaded down to a loaded draft mark, even when full of cargo. The subject matter of the paper is actually contained largely in tables comparing the following types of machinery and ships:

Geared turbines with Scotch boilers; geared turbines with watertube boilers; reciprocating steam engines with Scotch boilers; reciprocating steam engines with watertube boilers; Diesel engine 4-cycle; Diesel engine 2-cycle; for 5,000-ton freighter at 10½ knots; for 7,500-ton freighter at 11 knots; for 8,800-ton freighter at 10½ knots; for 10,000-ton freighter at 12½ knots; for 10,500-ton tanker at 10½ knots; for 17,000-ton displacement passenger ship at 15 knots.

The complete paper will be published in a later issue of Marine Engineering and Shipping Age.

Discussion

James C. Shaw, assistant to the chief engineer, William Cramp and Son's Ship and Engine Building Company, outlined comparative trials between different types of steam driven and Burmeister and Wain Diesel engine driven ships. He criticized the various comparisons in the paper and stated that basic data for the hulls and similar information should be included, so that comparisons might be more accurately drawn. Single screw motorships and twin screw steamships should not be compared nor where the reverse condition exists; that is, single screw steamships and twin screw motorships.

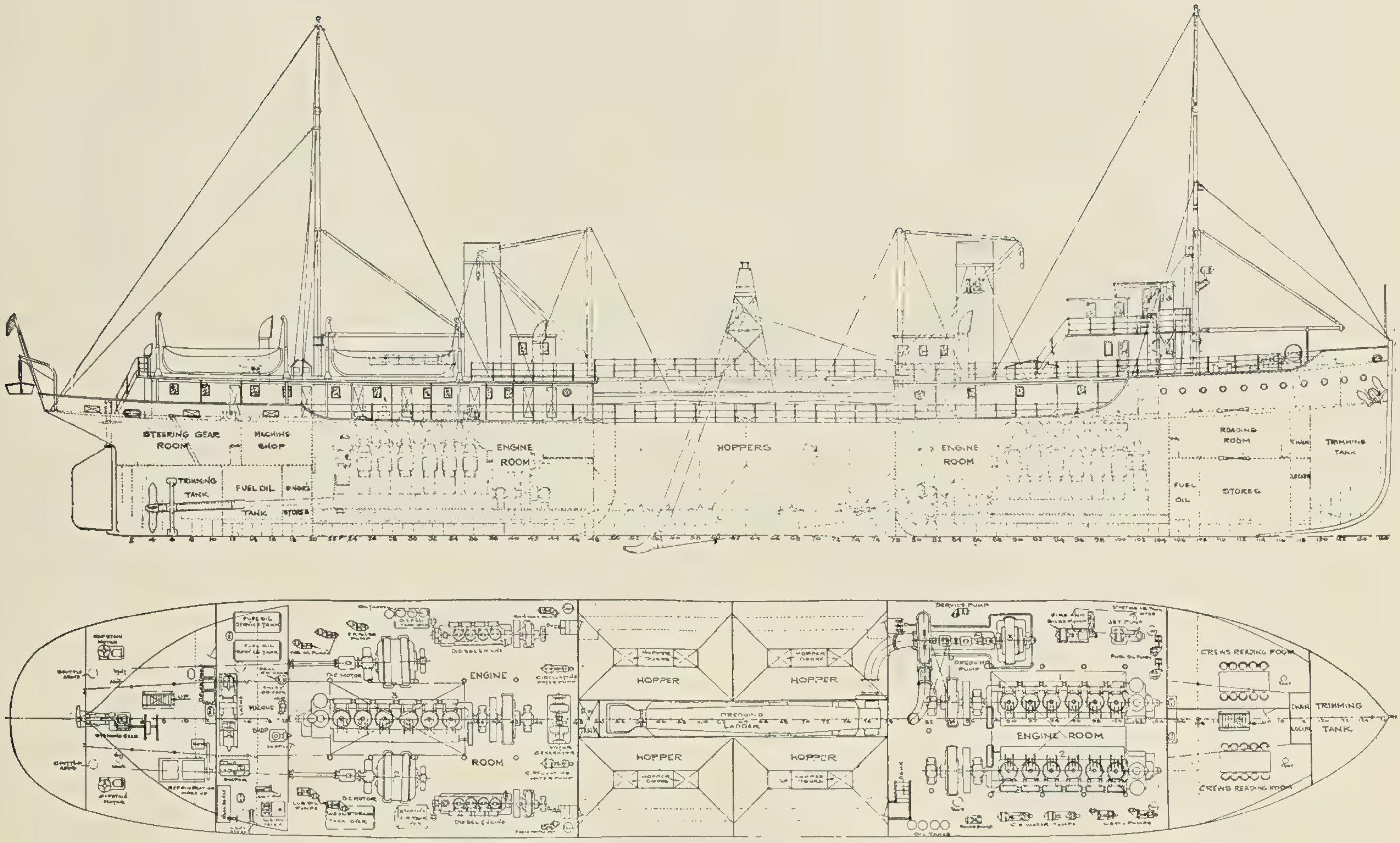
John L. Bogert cited examples of the low cost of motorship operation from data at hand. From data contained in the paper he pointed out that on a round trip voyage between this country and Scandinavia sufficient fuel could be carried in the double bottoms to fuel a motorship for the voyage and sell enough abroad to pay for the cost of fuel on the entire trip.

New Type of Low Pressure Expansion Joint

AT the recent Marine Show, held at the Grand Central Palace, New York, the Griscom-Russell Company, New York, exhibited one of their G-R type C expansion joints. In this joint the flanges are of cast iron and the expansion metal of copper. All sizes of the joint have a single corrugation. The special features of this device pointed out were the depth of the corrugation which is used, and the fact that the sides of the corrugation are actually parallel for at least one inch of their length. These joints are manufactured on a special patented machine and this exclusive patented method of rolling, it is claimed, insures a uniform thickness of copper after completion of the joint. Maintaining practically unchanged the original copper thickness permits the use of a thinner sheet than has previously been used, increases the flexibility of the joints and eliminates thinned spots.

The manufacturer states that these joints are guaranteed to compress ¼ inch axially when subject to a compressive force of 125 pounds per inch nominal diameter, and to be capable of distortion laterally ⅛ inch with a force of 125 pounds per inch nominal diameter. The joints are of the low pressure type and are designed particularly for use on steam lines between the turbine and the condenser.

This improvement in expansion joint design is the result of months of experimentation and development by the manufacturers.



Profile and Hold Plan of Army Diesel-Electric Hopper Dredges

New U. S. Army Dredges to Be Completely Electrified

Power for Propulsion, Dredging and Auxiliary Purposes Provided by Three 1,000-Horsepower Diesel-Electric Generator Sets

An excellent illustration of the growing tendency to use electricity on shipboard is provided by the four hopper dredges which were designed by the United States Engineer Corps and are being built by the Sun Shipbuilding Company, Chester, Pa. On these vessels electricity is to be used for every possible purpose. It will propel the ships and steer them; it will operate the dredging pumps and all of the auxiliary machinery; it will supply heat in winter, cool breezes in summer, and ventilation at all times; and it will furnish hot water and do the cooking. Quite literally, there will be no fires of any kind aboard these dredges, save those in the cigars and pipes of the officers and crews.

These dredges are intended for harbor work and are to be thoroughly seaworthy. They are to have a length overall of 268 feet 5 inches; molded breadth of 46 feet; draft of 19 feet 6 inches; and total deadweight carrying capacity of about 2,000 tons. Midships in each vessel there is a well 56 feet long and 7 feet wide in which the suction pipe of the dredging pump is suspended. This pipe is 26 inches in diameter and 50 feet long. It is carried by a ladder and is so arranged that the intake end can be lowered into the silt to be removed. The dredging pump is of the 26-inch, volute-centrifugal, single-suction type. It discharges into hoppers located on either side of the well which have a total capacity of 1,250 cubic yards per ship. When the hoppers are filled, the dredge proceeds to the open sea and empties them by means of doors in the bottoms.

The main engines of each dredge consist of three 1,000 brake horsepower McIntosh & Seymour Diesel engines, each of which will be directly connected to a 700-kilowatt, 500-volt, direct-current Westinghouse electric generator of 150 revolutions per minute. These generators will furnish the power for operating the propellers and the dredging pump.

Each dredge is to be propelled by twin screws, and each propeller is to be direct connected to an 800-horsepower, 480-volt, direct-current Westinghouse motor of the double-armature type. The speed of these motors can be varied from 90 to 110 revolutions per minute.

The main dredge pump is to be driven by a 750-horsepower, 480-volt, direct-current Westinghouse motor, which has a speed variation of from 135 to 160 revolutions per minute.

The windings of both generators and motors will be impregnated with moisture-resisting compounds and enclosed by protecting covers. Forced ventilation will be provided by small motor-driven blowers.

Advantages of the Drive

Four special advantages will be gained by the use of Diesel-electric drive on these dredges.

Economy of Operation.—Because of the fuel economy of the Diesel engine, the operating cost of these dredges will be less than if steam drive were employed.

Freedom as to the Arrangement of the Machinery.—Were the propellers and the pumps of these dredges driven by direct-connected engines of any kind, the positions of all of

these machines would be definitely fixed. In designing the vessels, therefore, the designer would be compelled to start with this machinery layout and adapt the dredging apparatus to it as best he could. With Diesel-electric drive, however, much greater freedom is given the designer, because the engine-generator units are not fixed as to location but can be placed almost anywhere on the vessel.

A study of the plans of these dredges shows that advantage has been taken of this fact. There are two engine rooms, one forward of the ladder well and containing the dredge pump, and the other aft of the well and containing the propeller motors. Only one engine-generator unit is placed in the aft engine room, while the other two are placed in the forward engine room at a considerable distance from the propellers and, moreover, off center. In other words, these vessels were designed primarily as dredges, and the machinery was fitted in wherever it could most conveniently go. Therefore, even if everything else were equal, these dredges will be more efficient *as dredges* than they would be, if the direct drive were used.

Interchangeability of Generators.—Were each propeller and the main dredge pump of these dredges driven by its own individual engine, the breaking down of any one of the engines would badly cripple the vessel on which the accident happened. Either the dredge pump would be out of commission, or the vessel would have to propel itself awkwardly with a single screw. But with the Diesel-electric drive the utmost flexibility of connections is permitted. The switching arrangements provide for seven different combinations; namely, any generator to any motor; any one of the three generators to both propeller motors; and either of two generators to the dredge motor. Consequently, the breaking down of one engine would not seriously interfere with the operation of either the dredge or the propellers, and even if two engines were down, the vessel could still be propelled without difficulty.

A special switching device has been designed to effect these various connections. This device is mounted on the main switchboard and consists of a group of contactors opened and closed by a system of cams which are operated by a handwheel. There are eight different positions for the handwheel, corresponding to the seven combinations and a point where all circuits are opened. The handwheel can be locked in each position, and cannot be moved until all circuits are open, so that heavy main-line currents are not broken by the contactors.

Ease of Maneuvering.—In accordance with standard Diesel-electric practice, all movements of the propeller motor are to be controlled by two small rheostats (one for each motor) located in the pilot house with duplicates in the engine room. The complete control of the vessel, therefore, will be in the hands of the navigating officer, which is very desirable because of the constant maneuvering that is required of these dredges.

Auxiliary Machinery

Among the motor-driven auxiliary machines on each dredge are 25 auxiliary pumps, 2 air compressors, the steering gear, a windlass, 2 capstans, 2 winches, 2 hopper-door openers, the ladder hoist and the refrigerating machine. Most of the motors for these machines are to be of the ordinary open standard type, with impregnated windings and non-corrodible small parts. The winch motors and the hopper-door motor, which are to be mounted on the open deck, are to be of the cast steel, watertight design which has proved so successful on the motorships *William Penn* and *Californian*.

The control of almost all of these motors is to be of the automatic type; that is, the operator merely pushes buttons or turns a light master switch to start, stop and control the speed of the motor. The use of controllers of this kind insures the maximum ease and safety of operation and is in line with modern industrial practice.

Included in the electrical equipment of each dredge are to be 88 electric room heaters, ranging from 1,000 to 5,000 watts each in capacity, three 5,000-watt water-heaters for each hot water boiler, 23 electric fans and two electric ranges of 22 kilowatts capacity each.

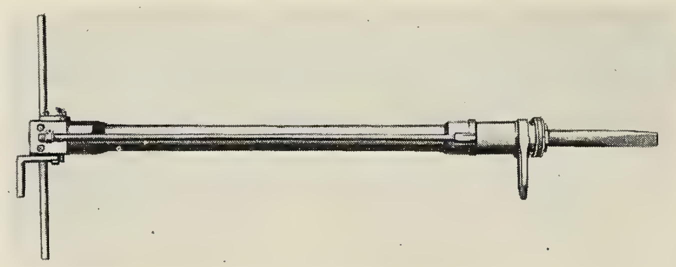
The auxiliaries will be supplied with current from two auxiliary Diesel engine driven 150-kilowatt, 250-volt generators, and also from a 150-horsepower motor-generator set which can be supplied with power from the generator normally used to operate the dredge pump motor.

All of the electrical equipment on these dredges is being supplied by the Westinghouse Electric and Manufacturing Company.

New Type Rivet Cutter

On the principle that when cutting rivets, a number of comparatively light, rapid blows cause more vibration and therefore more distortion of steel plates than a few intermittent, heavy blows, the Chicago Pneumatic Tool Company, New York, has designed and manufactured a new type of rivet cutter known as the "Boyer Superior."

Its construction is described as consisting of a dead handle, a throttle handle of the crank design, a throttle valve of the taper type, a back head screwed onto the cylinder and secured by a locking device, a cushion chamber in the rear end

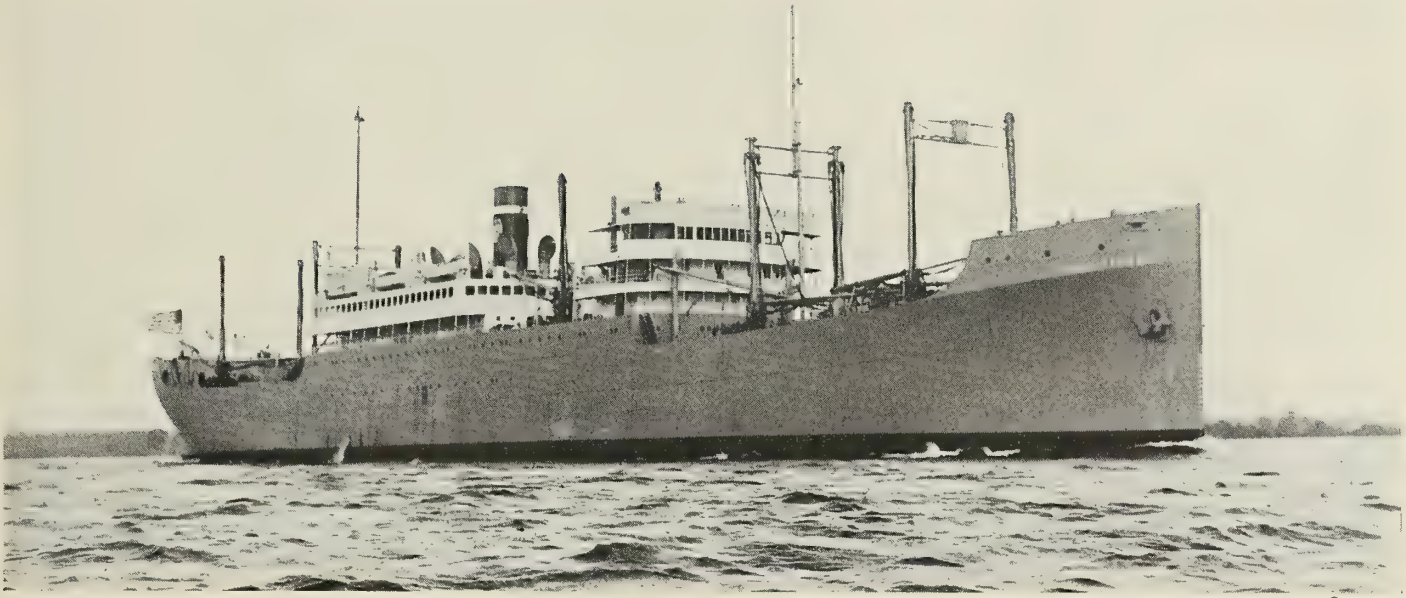


Improved Rivet Cutter

of the cylinder, a cylinder of seamless steel tubing, a bypass from back to front head, a non-removable electrically welded front head, square coiled spring buffer, adjustable chisel lock, hand hold of the spade handle type and chisel.

To operate, the throttle handle is moved in a line parallel with the cylinder. Each forward and return stroke of the piston is hand controlled. About four blows, requiring approximately 10 to 15 seconds, are said to be required to cut off the head of a ¾-inch rivet. Two men are required to operate the machine. It can be used wherever rivets are to be cut.

Mechanical Engineers' Annual Meeting.—The annual meeting of the American Society of Mechanical Engineers will be held at 29 West 39th street, New York City, December 4 to 7. On Monday, December 4, there will be public hearings on the Boiler Code and a joint session with the American Society of Refrigerating Engineers. On Tuesday there will be sessions covering management, machine shop practice, materials handling, training for the industries, research, steam tables, a public hearing on power test codes and a general session. On Wednesday the general session will be continued and there will be sessions covering fuels and railroad practice. In the evening there will be a joint session with the American Economic Association. On Thursday are scheduled sessions on power, standardization, safety engineering, ordnance, aeronautics and forest products.



©New York Shipbuilding Corporation

One of the 502-Foot Shipping Board Passenger Vessels

Shipping Board Establishes Standard for Efficient Performance of Its 502-Foot Passenger Vessels

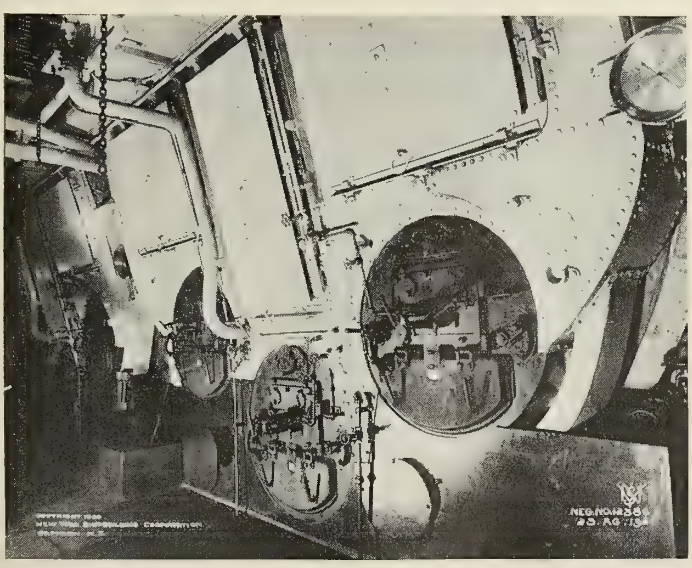
Fuel Conservation Committee Adopts Mileage Traveled Per Ton of Fuel, Based on Average Conditions, As the Standard

THE campaign of the United States Shipping Board to increase the efficiency of operation in the engine department, and thereby reduce the fuel bill, of the vessels operated by the Board is being carried out by the workings of the Fuel Conservation Committee, appointed by Vice-President Joseph E. Sheedy of the United States Shipping Board Emergency Fleet Corporation, from the various engineering societies and organizations. The members of this committee are:

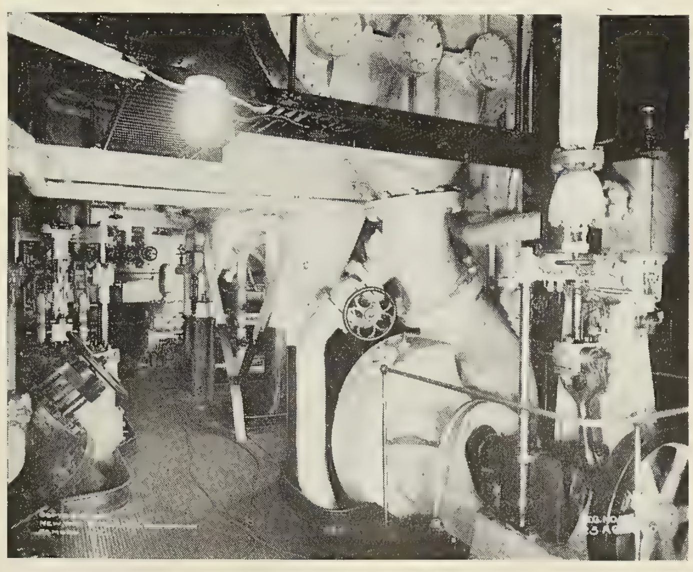
Captain C. A. McAllister, chairman; Commander R. D. Gatewood (C. C.), U. S. N.; E. H. Peabody, D. M. Myers, Maurice Healey, Major George M. Talbot, F. B. Webster, H. B. Taylor, C. J. Jefferson, E. A. Stevens and C. H. Jack.

Many engineering problems of a most interesting nature to the marine world have already arisen. Chief among these problems has been that of establishing a standard of performance that is applicable to the every day operation of a fleet made up of several score types of vessels, this standard to be reasonably correct for average conditions and not to be based on the results obtained on any single short trial trip performance.

To solve this problem, the active fleet of the United States



Oil Burning Boilers



Engine Room Auxiliaries

Average Data for Performance Standardization: 502-Foot Passenger and Freight Vessels

Vessel	Draft	R.P.M.	Observed Speed	Tons Fuel per 24 Hrs.	Lbs. Fuel per Mile	Knots per Ton A Actual	Knots per Ton B Theoretical	Knots per Ton A/B Correction Factor
President Polk	22′ 9½″	96.7	13.7	73.1	502.4	4.47	4.24	1.053
President Van Buren	21′ 9¾″	106.3	14.67	101.86	648.6	3.46	3.60	0.9609
President Garfield	23′ 2½″	101.6	14.5	100.4	646.3	3.48	3.54	0.955
President Adams	22′ 1¾″	104.9	14.26	97.6	637.26	3.53	3.67	0.9339
President Harrison	23′ 3¾″	95.5	13.08	74.3	529.3	4.25	4.79	0.9025
President Hayes	23′ 3½″	94.3	13.26	80.3	564.9	3.97	4.42	0.897
President Monroe	20′ 11¾″	100.96	13.80	99.95	673.43	3.34	4.14	0.806
Grand average	22′ 7½″	100.8	13.9	89.6	600.9	3.74	4.06	0.921

Shipping Board has been cataloged under a minimum number of classes, the factors affecting this cataloging being: type of boilers, type of driving machinery, hull design, kind of fuel, type of auxiliaries and the propeller design.

The next step in the problem was to establish a factor of performance which would be subjected to the least variable and which could be determined the most accurately. The ideal factor to use would be the British thermal units per indicated horsepower relation, but this could not be used as the collection of the necessary data to utilize such a standard would be well nigh impossible and in order to obtain data which would give even reasonable approximation of the actual value, the cost would offset the gains made in the efficiencies of performance, which is a frequent fault of efficiency engineers and is being carefully avoided by the Fuel Conservation Section.

The final standard adopted as the one least subject to variables and which could be applied most accurately and readily to actual performance is the mileage per ton of fuel.

The standardization curves are based on effective horsepower curves made from tests on the tank models with corrections made for average weather, deep sea and average bottom condition, the horsepower at various speeds and drafts having been determined. The fuel consumption was computed using a variable fuel per indicated horsepower value, depending upon the percentage of auxiliary load to main engine power and the varying water rates of main engine at different percentages of power developed with the varying evaporation factor based upon percentage of the boiler power developed. The accompanying curves show the standards developed for the 502-foot passenger vessels of the *President Polk* (ex—*Granite State*) class.

Standards Developed for 502-foot Passenger Vessels of the President Polk Class, Built by the New York Shipbuilding Corporation

The principal characteristics are as follows:

Length between perpendiculars	502 feet 0 inches
Breadth	62 feet 0 inches
Depth	42 feet 0 inches
Loaded draft	32 feet 3 inches
Deadweight tonnage	13,000
Speed (knots)	14.5
Engines	2-4-cylinder triple expansion 7,000 horsepower
Propellers	2
Boilers	6 Scotch
Heating surface (each)	2,666 square feet
Built by	New York Shipbuilding Corporation, Camden, N. J.

The curves are applicable to average deep sea and average weather conditions, so with extraordinarily smooth seas a plus correction must be applied while with very heavy seas a minus correction is used. The curves do not represent the maximum efficiencies that can be produced by the vessels of this class. They do, however, give a possible performance standard which all of the vessels can attain without extraordinary modifications in their equipment.

The tabulated actual performances of seven of these vessels for a number of voyages show how these curves can be used to determine the efficiency of performance. It will be noted that the average efficiency for these vessels is 92 percent while the best showing is 105 percent and the poorest performance is 80.6 percent.

This variance in efficiency is traceable to the condition of furnace fittings, condition of steam and water end of auxiliaries, condition of main engine piston and cylinders, methods of operation and other like causes, all of which can and will be corrected and the results of the methods employed in making these corrections can be readily checked by referring the performance to the standards shown on the curves.

This is the first class of vessels for which these standards have been developed by the Fuel Conservation Committee and represents but the beginning of a large task. It is, however, a definite step along the lines of real efficiency engineering and a constructive effort towards the permanency of the United States merchant marine.

South American Mail Subsidy Continued.—The ten-year contract between the Government of the Union of South Africa and the Castle-Vail Steamship Company for transporting weekly the mails in both directions between Southampton and Cape Town, which expired September 30, 1922, has been extended for two years.

How Propeller Position Affects Propulsive Efficiency

Paper read at annual meeting of Society of Naval Architects and Marine Engineers by Rear Admiral D. W. Taylor (C. C.), U. S. N., honorary vice-president of the Society, dean of American naval architects and former Chief Constructor of the United States Navy, giving results of Model Basin experiments on propeller position and propulsive efficiency for single-screw low-speed vessels.

AFTER publication of results of years of Model Basin experimentation, the naval architect and marine engineer can now determine in advance with reasonable accuracy, for normal forms, the effective horsepower of a ship and the dimensions and proportions of a propeller which would propel the ship with high efficiency, if it were Froude's phantom ship, which has the resistance of the actual ship but is assumed not to disturb the water.

But we have to deal with actual ships, and the reactions between ship and propeller are very complicated phenomena. The wake of the ship of course affects the action of the propeller, and the suction of the propeller adds to the resistance of the ship. The thrust deduction is always positive, *i. e.*, the thrust is greater than the resistance of the ship without the propeller. Nearly always, however, the wake is also positive, which tends to increase the efficiency of propulsion. We generally and conveniently characterize the net results of the opposing factors as hull efficiency. If this is unity, the power required to propel the actual ship is the same as if it were Froude's phantom ship, while a hull efficiency greater than unity means that we can get along with less power and vice versa.

Factors Affecting Hull Efficiency

A brief enumeration of the factors affecting hull efficiency indicates the difficulties of dealing with it accurately. Considering the hull, it is affected by dimension and shape, but more particularly by the fullness and shape of the after body. A "V" stern, for instance, will show a somewhat different wake from a "U" stern, and the thrust deductions upon it will not be quite the same.

Considering the propeller alone, the hull efficiency must be somewhat dependent upon its dimensions and proportions, blade area, blade thickness, shape of blade, etc.

Considering the combination of ship and propellers, the hull efficiency must be affected by the number and locations of the propellers. For a single-screw ship, the propeller position may be varied vertically and longitudinally. For vessels of two or more screws, locations may be varied transversely for side screws.

For high-speed ships the hull efficiency must be affected by speed.

Probably of the many factors involved, those of location are most in need of systematic investigation because in many practical cases there is some choice of location and we would like to know whether we can gain anything by making a proper choice, and also whether we could gain by so shaping our designs as to permit a favorable location without counterbalancing loss in other respects.

Location of Propeller for Single-Screw Low-Speed Vessel

The experiments which are the subject of this paper, recently made at the United States Model Basin, deal with the question of location for a single-screw low-speed vessel. They were initiated while I was chief constructor, and my successor, Chief Constructor Beuret, has kindly permitted their publication. The lines of the model used are shown in Fig. 1, and it will be observed that it is of rather a full type. It is hoped that at some future time, if an opportunity permits, the stern lines may be further fined and the experiments repeated.

Fig. 2 shows the three model propellers used. With the possible exception of 571, they were smaller than would be used for the actual ship in practice. This permits a maximum vertical change of position and insures that the propellers work at a high real slip and cover a wide variation of slip. Fig. 3, supplemented by Table I, shows the test positions for the propellers, three positions at the upper level, three at the lower level, and three propellers used in each position. It was then necessary to make eighteen sets of runs at each speed of model. Figs. 4, 5 and 6 show the usual characteristic curves of the three propellers as tested apart from the model. In making the tests with the pro-

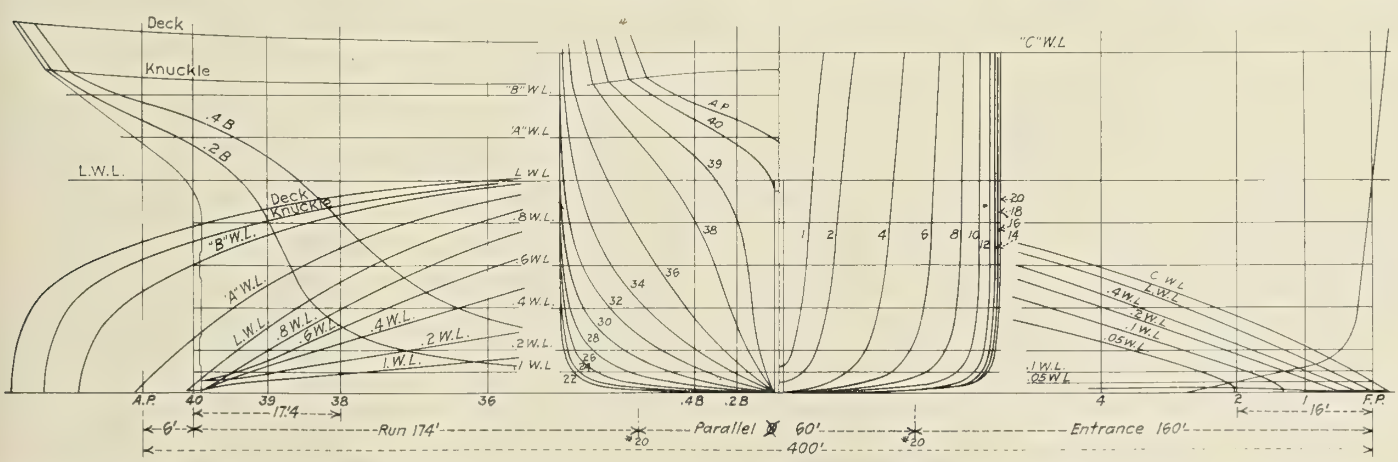
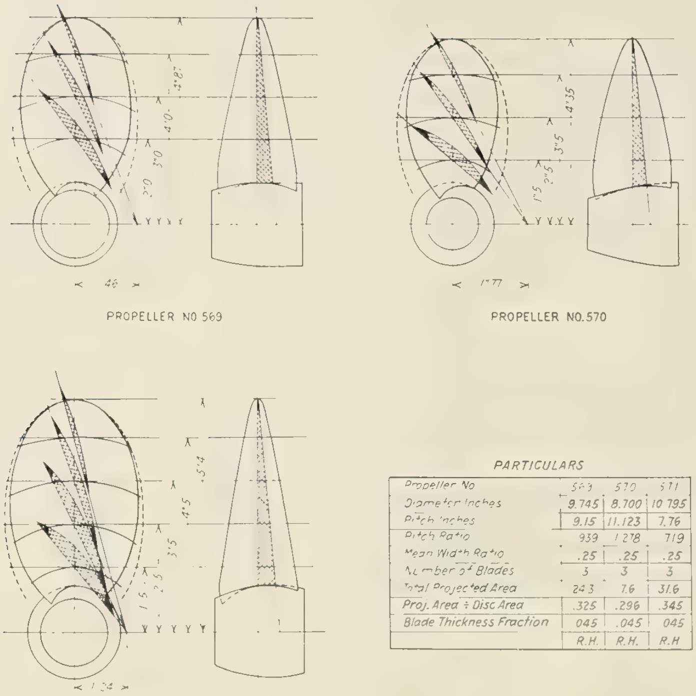


Fig. 1.—Lines of Model No. 2441, Representing 400-Foot Ship: Length of Ship Between Perpendiculars, 400 Feet; Beam, 52 Feet; Draft, 25 Feet; Displacement in Sea Water, 11,150 Tons; Block Coefficient, 0.75; Midship Section Coefficient, 0.975; Longitudinal Coefficient, 0.769



PARTICULARS

Propeller No	569	570	571
Diameter Inches	9.745	8.700	10.795
Pitch Inches	9.15	11.123	7.76
Pitch Ratio	.939	1.278	.719
Mean Width Ratio	.25	.25	.25
Number of Blades	3	3	3
Total Projected Area	24.3	17.6	31.6
Proj. Area ÷ Disc Area	.325	.296	.345
Blade Thickness Fraction	.045	.045	.045
	R.H.	R.H.	R.H.

Fig. 2.—Model Propellers Used with Model No. 2441

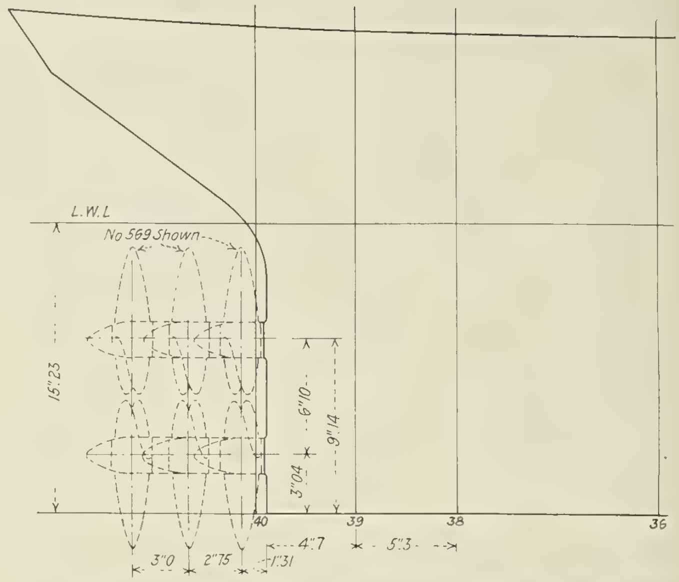


Fig. 3.—Positions of Model Propellers in Tests of Model No. 2441

pellers attached, the model was self-propelled at the desired speed, the torque and thrust being determined. From this there were deduced the two quantities w and t. The average speed of the wake over the propeller area is the speed of the ship multiplied by w, the wake fraction. The thrust deduction coefficient t is a quantity such that the actual thrust multiplied by the factor $(1 - t)$ is the resistance of the vessel without the propeller. The hull efficiency, as usual, is expressed by $1 - t/1 - w$.

Tests were made at a number of speeds extending from 2 knots speed of the model to 2.8 knots speed of the model, but the variations in the results with speed were not sufficiently marked with this model to be significant.

Results of Tests

Fig. 7 shows the reduced results in the small tables, each located with its center in the same position relative to the ship (indicated by the stern outline) as the propeller centers. As is to be expected from a single set of experiments on such a small scale, there are some inconsistencies in the results. It would require other experiments enabling cross-fairing to eliminate them. Broadly speaking, however, Fig. 7, which is confirmed by the results at other speeds, shows that the dimensions and proportions of the screw had a minor effect upon the hull efficiency. The very wide variation of slip resulting from the variation in screw dimensions had

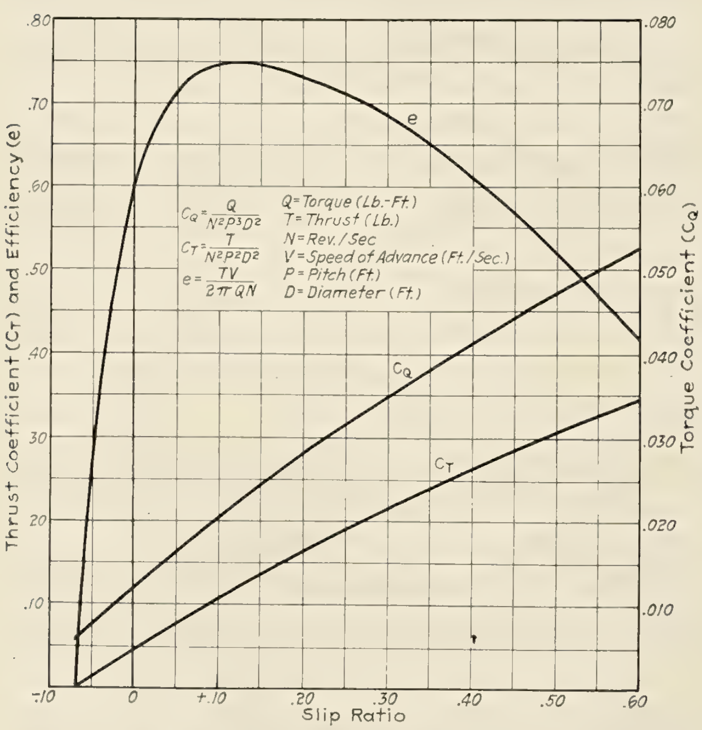


Fig. 4.—Propeller No. 570, Coefficients and Efficiency

Diameter, 8.70 inches; mean width ratio, 0.250; pitch, 11.37 inches, R.H.; number of blades, 3; speed of advance, 2.5 knots; blade tips submerged 4⅞ inches.

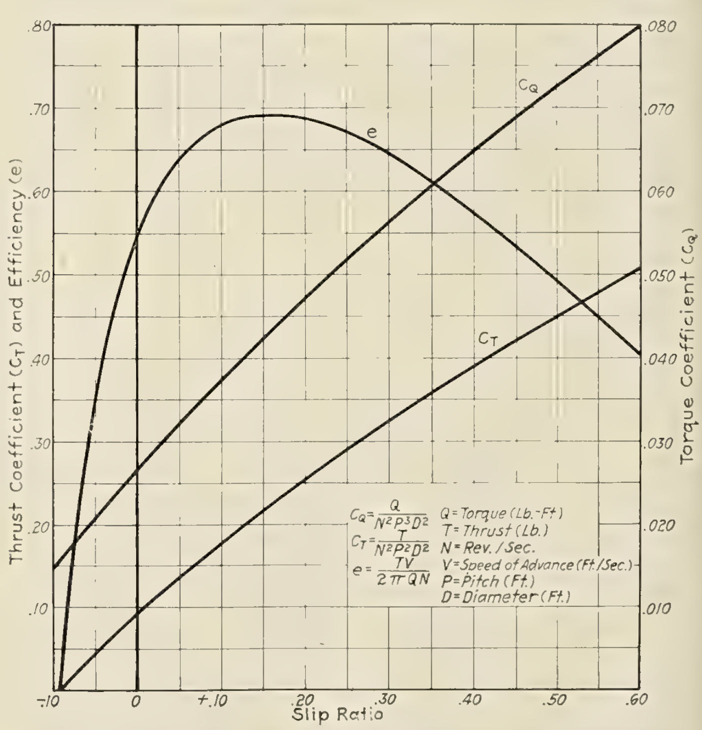


Fig. 5.—Propeller No. 569, Coefficients and Efficiency

Diameter, 9.745 inches; mean width ratio, 0.250; pitch, 9.25 inches, R.H.; number of blades, 3; speed of advance, 2.5 knots; blade tips submerged 4⅜ inches.

comparatively little effect. At each level, as the screw was placed further and further aft, the wake fraction and thrust deduction coefficient fell off steadily. These changes rather neutralize one another, so that in this case it does not appear there was any material gain by variation in the fore and aft position of the propeller. When, however, we consider the vertical variation, it is another story. For the upper locations the hull efficiency is consistently higher than for the lower, the gains being somewhere between 15 and 20 percent. This is in accordance with what might be expected from theoretical considerations.

It would seem that the naval architect is confronted by another case of conflicting tendencies where a compromise is necessary. For the majority of vessels virtually all considerations, except that of hull efficiency, dictate the lowest practicable position of the propeller. Doubtless in sea-going vessels with reciprocating engines the considerations dictating maximum submergence must preponderate, but for vessels with types of propelling machinery not subject to racing in heavy weather, and for vessels primarily for smooth-water service, we cannot ignore the fact that the higher the propeller location the greater the hull efficiency and hence possible efficiency of propulsion.

I say "possible" efficiency of propulsion because to take full advantage of the greater wake associated with high propeller locations, the high propeller should be of somewhat greater diameter than the low propeller for such a vessel as Model 2441.

In conclusion, I should like to record my appreciation of the assistance in the preparation of this paper given me by the Model Basin Staff, headed by Captain Eggert (C. C.), U. S. N., in charge of the Model Basin. It was necessary to interfere with other important work to get in these experiments. I hope further experiments along this line, planned at the Model Basin, may appear in the *Transactions* of the Society in due time.

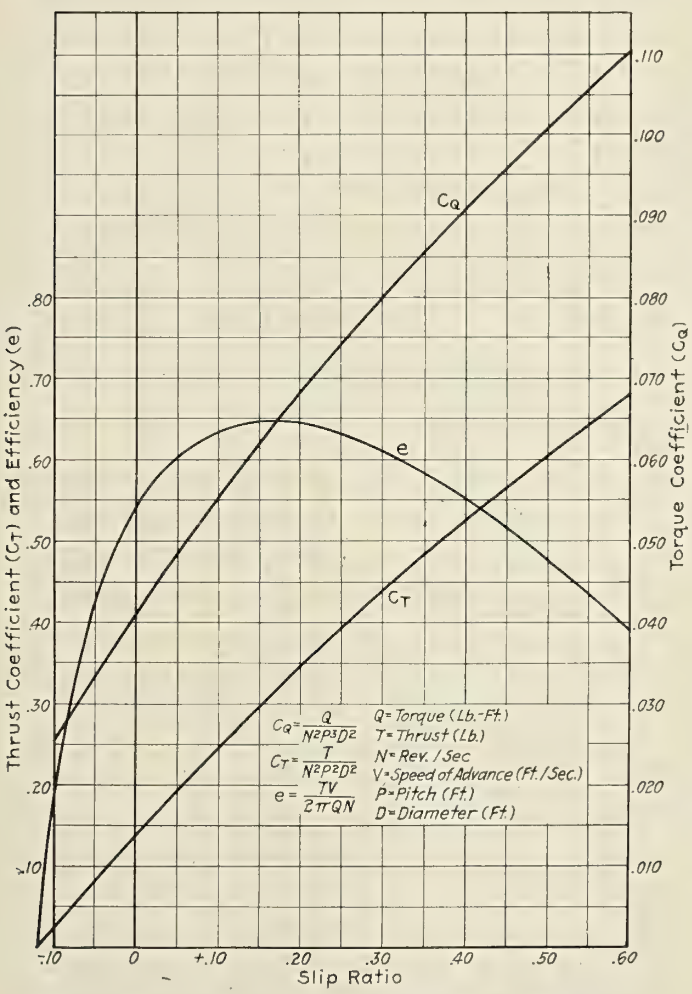


Fig. 6.—Propeller No. 571, Coefficients and Efficiency

Diameter, 10.795 inches; mean width ratio, 0.250; pitch, 7.82 inches, R. H.; number of blades, 3; speed of advance, 2.5 knots; blade tips submerged 3⅞ inches.

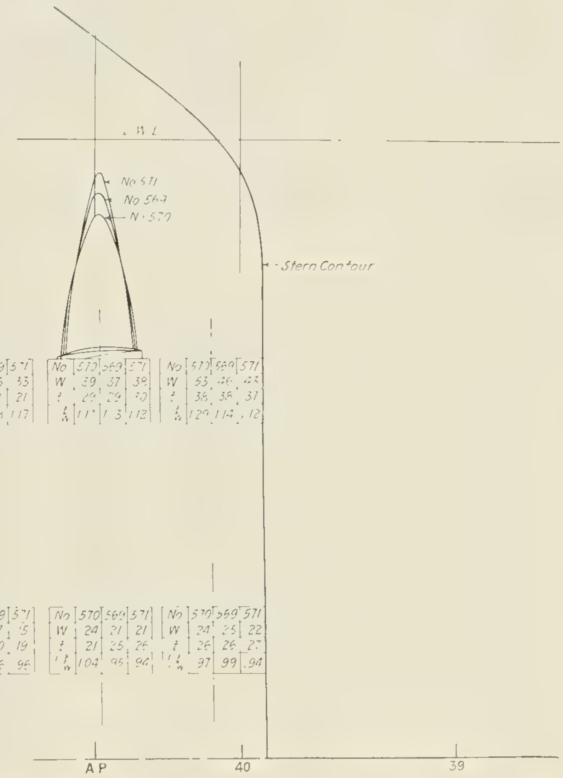


Fig. 7.—Wake Fraction, Thrust Deduction and Hull Efficiency Tabulated at Respective Positions Relative to Hull at Which Observed. Model Speed, 2.6 Knots; Ship Speed, 11.57 Knots

TABLE I.—PROPELLERS FOR MODEL 2441

Models $\frac{1}{19.7}$ full size.

Propeller No.	570	569	571
Diameter	8.7″	9.7″	10.8″
Pitch	11.4″	9.2″	7.8″
Tips submerged, upper position	1.7″	1.2″	0.7″
Tips submerged, lower position	7.8″	7.3″	6.8″
Tips below keel, lower position	1.3″	1.8″	2.4″

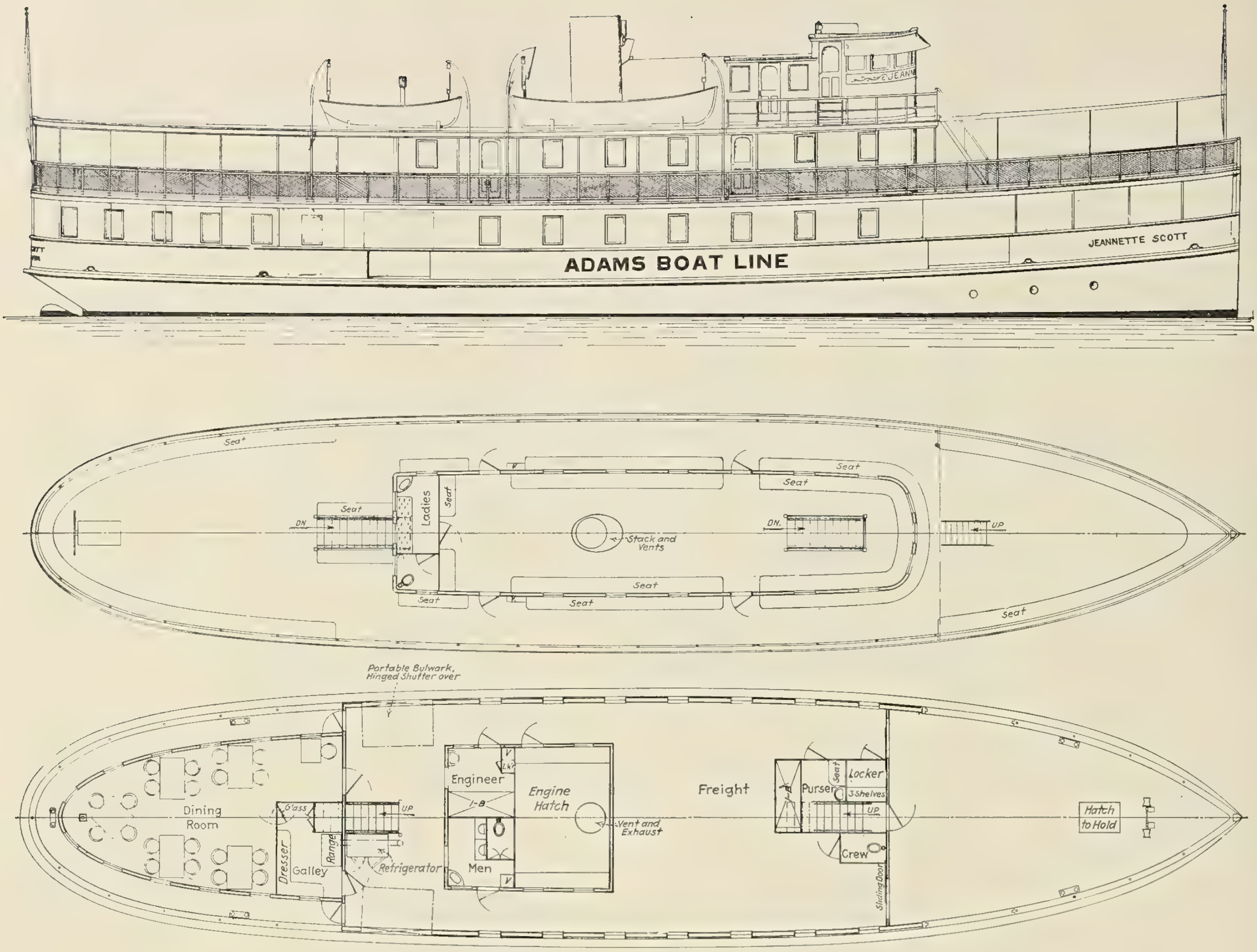
Correction

IN connection with the article on "Line Shafts for Marine Internal Combustion Engines," by Joseph Hecking, in the November issue of MARINE ENGINEERING AND SHIPPING AGE, the attention of our readers is directed to a printer's error in the formulæ Nos. 11 and 12 on page 718.

In both formulæ the value (1 + C) should be added, so that the formulæ will read, respectively, as follows:

$$d = .683 \sqrt[3]{\frac{p D^2 S N}{5{,}000} (1 + C)} \qquad (11)$$

$$d = .861 \sqrt[3]{\frac{p D^2 S N}{5{,}000} (1 + C)} \qquad (12)$$



M. S. Jeannette Scott: Profile and Deck Plans

Freight and Passenger Vessel for Florida Service

Mobile Shipyard Building Wooden Motorship, Reinforced with Steel, Designed by Cox and Stevens for Adams Boat Line

THERE is now under construction at the Murnan Shipbuilding Corporation, Mobile, Ala., a new freight and passenger boat equipped with oil engines which is being built from the designs of Cox and Stevens, naval architects, New York, and under their supervision for the Adams Boat Line, Inc. This company does business between Tampa, St. Petersburg, Manatee River and Sarasota Bay towns. The new boat, however, will be used on the run between Tampa, St. Petersburg, Palmetto and Bradentown.

The general type of this new boat, which will be called the *Jeannette Scott,* is somewhat of a departure, the hull being of wood reinforced with steel, and the machinery of the heavy oil type. The dimensions are as follows:

Length overall	120 feet
Length on waterline	114 feet
Beam	25 feet 6 inches
Depth	8 feet
Draft	4 feet 10 inches

On the main deck, in addition to the usual open freight space forward, there is an enclosed freight deck amidships, while aft are the dining room and galley. The quarters for the engineer, purser's office and the men's toilet are also on this deck.

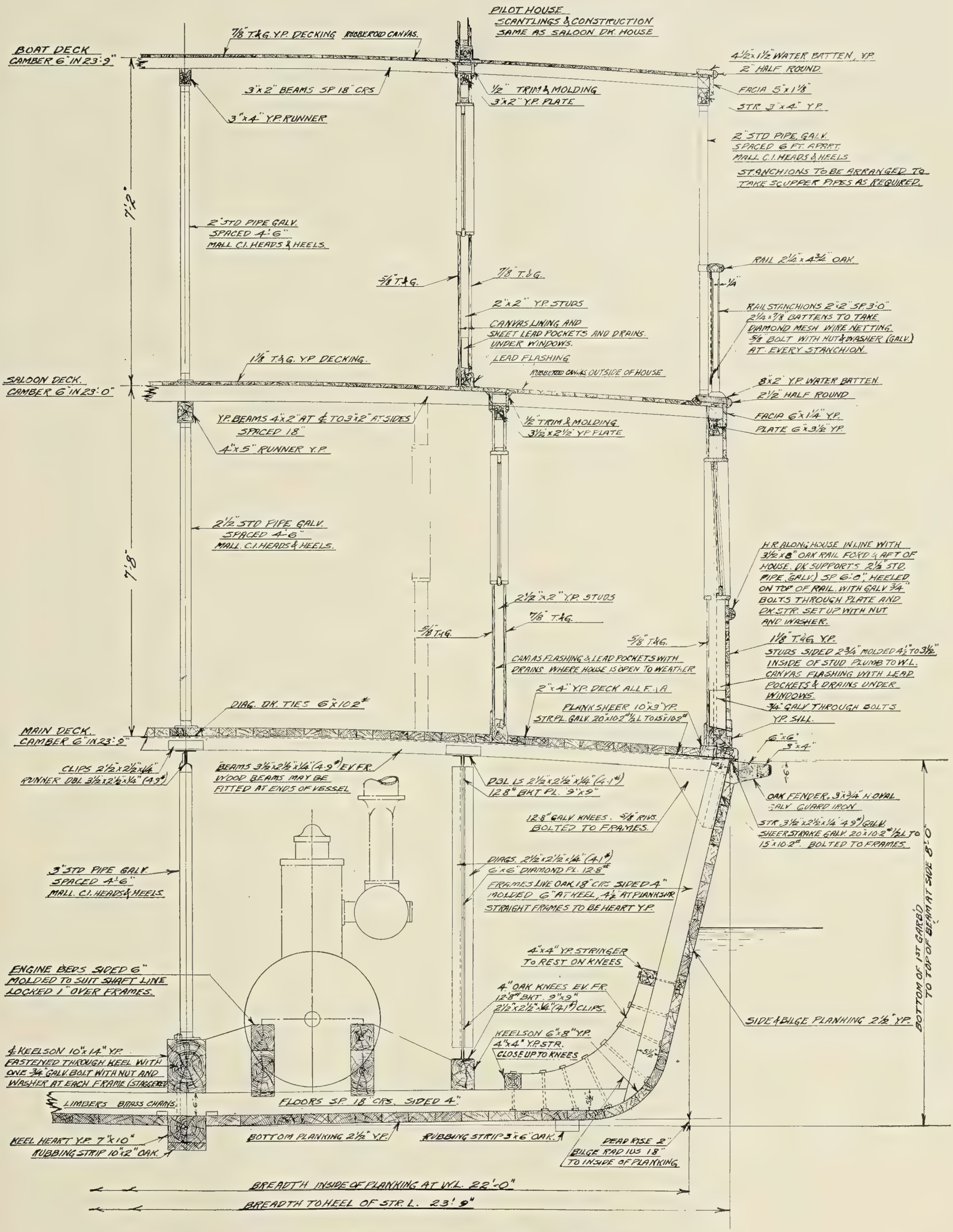
On the upper deck there is a long central deckhouse amidships, with ladies' rest room at the after end, and also a very considerable amount of promenade and lounging space, both on each side of the deckhouse and at the after end, all this space being covered by an awning deck.

The pilot house, with quarters for the captain and mate, is forward on top of the awning deck. Accommodations for the crew are below in the forecastle.

The machinery equipment consists of two 4-cylinder heavy duty oil engines built by the Kahlenberg Brothers Company, having a bore of 10 inches and a stroke of 10½ inches, which will deliver 120 brake horsepower each at 340 revolutions per minute.

This new boat will be completely equipped in every respect, the auxiliaries including an unusually efficient outfit of pumps, electric light plant and all equipment necessary for a craft of this type.

The general appearance of the new boat will be attractive, as she has pleasing lines, and with a large center stack, used for ventilation and exhaust, will present an attractive and workman-like appearance. This boat will be delivered to her new owners this month and will immediately be placed in active service.



M. S. Jeannette Scott: Midship Section

Ropes, Chains and Blocks for Shipbuilding Purposes

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials' point of view.

BOTH wire and vegetable fiber ropes are made of several different materials and made up in various ways, to satisfy special requirements of strength, flexibility and wear. The relative merits of the different materials and the different ways of making them up into ropes are clearly set forth by the rope manufacturers, whose catalogs are valuable text books on the general subject. We are, however, particularly concerned with ship operating requirements, and will call attention to some of the more important considerations in this line which affect the selection of the different ropes, etc. This can be best done by dealing with them under the headings of the specific services.

Chains and blocks will be referred to under the headings where they are likely to be met with, the latter being considered particularly with reference to the ropes or chains that they have to accommodate.

Sizes given refer to ordinary merchant ship practice unless otherwise stated.

Wire Rope

When dealing with wire rope the chief considerations are strength and flexibility. The three main classifications are plow steel, cast steel and iron, the first mentioned being the strongest and the last, which is seldom required for shipboard service, being the weakest. Wire rope usually has a hemp core and in some cases each strand has a hemp core.

The purpose of this core is to increase the flexibility of the rope, to retain a lubricant which adds to the life of the rope and also to minimize internal friction from contact of the wires with each other. A mixture of a heavy bodied oil and black lead makes a good lubricant, and running ropes should be kept lubricated.

The flexibility is largely a question of the size of the individual wires used. A rope with 6 strands and 7 wires to a strand is as stiff a rope as is regularly made, and one with 6 strands and 37 wires to a strand is extra pliable. The last mentioned rope in the sizes generally met with on shipboard has wires a little too fine to withstand the abrasion of shipboard service.

Where strength and flexibility are both important factors the plow steel rope should be used rather than a larger diameter cast steel rope of equivalent strength. In some special cases bronze ropes are required. Wire ropes are often referred to as 6 x 7 rope, 6 x 19 rope, etc., the first figure being the number of strands and the second the number of wires per strand. When ordering wire rope it is well to specify that all unworked ends shall be well served.

Tables I to V inclusive give the minimum ultimate strengths that some of the wire ropes referred to later on in this article should possess. These or greater values can be readily furnished by the wire rope manufacturers. Weights can be obtained from the manufacturers' catalogs. A factor of safety of at least 5 should be used.

There is a proprietary wire rope, called "Durable," wire rope in which each strand of wires is served with a tarred hemp marline, the rope also having the customary hemp center. The serving reduces the friction between the strands and protects the wires from corrosion. The wires are not galvanized. The rope is very flexible and has found considerable favor where this factor is most important.

Fiber Rope

Fiber rope is made principally from Manila hemp, Russian, Italian and American hemp and sisal fibers. Manila, which botanically is not a hemp fiber, is much superior to the others in length, strength and lasting qualities, and is universally selected for marine purposes. Tarred hemp is

Table I—Galvanized Steel Wire Rope, 6 x 24 Construction, (7) Hemp Centers.

Diameter, inches	Circumference, inches	Ultimate Strength, pounds per sq. in.
1	3	50,000
1 1/16	3 1/4	54,000
1 1/8	3 1/2	64,000
1 3/16	3 3/4	74,000
1 1/4	4	84,000
1 3/8	4 1/4	92,000
1 7/16	4 1/2	100,000
1 1/2	4 3/4	110,000
1 5/8	5	122,000
1 11/16	5 1/4	135,000
1 3/4	5 1/2	150,000
1 13/16	5 3/4	165.000
1 15/16	6	180,000

Table II—Galvanized Cast Steel Wire Rope, 6 x 7 Construction

Diameter, inches	Circumference, inches	Ultimate Strength, pounds per sq. in.
3/8	1 1/8	8,200
7/16	1 1/4	10,000
1/2	1 1/2	14,000
9/16	1 3/4	18,000
5/8	2	23,400
3/4	2 1/4	33,600
13/16	2 1/2	38,000
7/8	2 3/4	44,000
1	3	56,000
1 1/16	3 1/4	62,000
1 1/8	3 1/2	68,000
1 3/16	3 3/4	76,000
1 1/4	4	84.000
1 3/8	4 1/4	95,400
1 1/2	4 1/2	113,000

Table III—Galvanized Cast Steel Wire Rope, 6 x 19 Construction

Diameter, inches	Circumference, inches	Ultimate Strength, pounds per sq. in.
1 5/8	5	129,000
1 3/4	5 1/2	153,000
1 7/8	5 3/4	172,000
2	6 1/4	190,000

Table IV—Galvanized Plow Steel Wire Rope, 6 x 19 Construction

Diameter, inches	Circumference, inches	Ultimate Strength, pounds per sq. in.
3/8	1 1/8	10,300
7/16	1 1/4	14,000
1/2	1 1/2	18,000
9/16	1 3/4	22,100
5/8	2	27,900
3/4	2 1/4	41.400
7/8	2 3/4	52,200
1	3	68,400
1 1/8	3 1/2	84,600

Table V—Galvanized Cast Steel Wire Rope, 6 x 19 Construction

Diameter, inches	Circumference, inches	Ultimate Strength, pounds per sq. in.
5/16	1	5,500
3/8	1 1/8	8,400
7/16	1 1/4	10,000
1/2	1 1/2	14,000

* Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

Table VI—Common Lay Three-Strand Manila Rope. Approximate Gross Weight and Strength

Name and Size in Circumference	Approx. Diameter	Approx. Length and Weight, Standard Coil: Feet	Pounds	Approx. Tensile Strength, New Manila Rope	Length of Rope in One Pound	Weight per Foot, in Pounds
6 thd. ¾"	¼"	2,750	50	700	55' 0"	.018
9 thd. 1"	5/16"	1,820	50	1,100	36' 4"	.027
12thd. 1⅛"	⅜"	1,350	50	1,500	27' 0"	.037
1¼"	7/16"	1,200	65	1,800	18' 6"	.054
1⅜"	15/32"	1,200	75	2,000	16' 0"	.063
1½"	½"	1,200	90	2,500	13' 4"	.075
1¾"	9/16"	1,200	125	3,000	9' 7"	.104
2"	⅝"	1,200	160	4,000	7' 6"	.133
2¼"	¾"	1,200	198	5,000	6' 1"	.165
2½"	13/16"	1,200	234	5,550	5' 1"	.195
2¾"	⅞"	1,200	270	6,600	4' 5"	.225
3"	1"	1,200	324	7,800	3' 8"	.270
3¼"	1 1/16"	1,200	378	9,200	3' 2"	.315
3½"	1⅛"	1,200	432	10,500	2' 9"	.360
3¾"	1¼"	1,200	504	12,200	2' 5"	.420
4"	1 5/16"	1,200	576	13,700	2' 1"	.480
4¼"	1⅜"	1,200	648	14,900	1' 10"	.540
4½"	1½"	1,200	720	17,400	1' 8"	.600
4¾"	1 9/16"	1,200	810	19,000	1' 6"	.667
5"	1⅝"	1,200	900	21,800	1' 4"	.750
5½"	1¾"	1,200	1,080	27,700	1' 1"	.900
6"	2"	1,200	1,296	31,000	11"	1.08
6½"	2⅛"	1,200	1,512	33,500	9½"	1.26
7"	2¼"	1,200	1,764	36,200	8"	1.47
7½"	2½"	1,200	2,016	42,300	7"	1.68
8"	2⅝"	1,200	2,304	47,300	6¼"	1.92
8½"	2⅞"	1,200	2,590	54,200	5½"	2.16
9"	3"	1,200	2,915	60,000	5"	2.43
9½"	3⅛"	1,200	3,240	67,000	4½"	2.70
10	3¼"	1,200	3,600	74,200	4"	3.00

desirable for some special ropes of small diameter; other special lines are made of cotton. A yarn or thread is first made up of a number of fibers twisted together, then the strand is made up of two or more yarns twisted together in the opposite direction; the rope is formed of three or more strands twisted together in the opposite direction to the twist in the strands. A 3-strand rope is stronger than a 4-strand rope of the same size. A cable is made up of three or four of these ropes twisted together in the opposite direction to the twist in the ropes. It is not as strong as a plain laid rope of equal diameter but is more elastic and stands greater surface wear.

The strength of a rope is dependent to some extent upon the amount of twist or "lay" in it. The softer the lay, the stronger the rope, but the less the wearing qualities. The softer lays are generally desired for marine purposes. An extra strength rope obtained by a careful selection and preparation of the fibers, the use of finer fibers and a finer spinning of the threads or yarns is called bolt rope. It is a better wearing rope than the ordinary grade. Its lay is generally soft.

The general run of ropes on shipboard are of the 3-strand variety. Ropes at the Boston Navy Yard are made only in 3 strands from 3-inch circumference down, and are made in 4 strands from 3¼-inch circumference up unless specially ordered 3 strands. Four strand rope is made either with or without a center core. The latter is the marine type and has generally a softer lay than the former. Four strand rope costs somewhat more than three strand rope per pound and is from 5 to 7 percent heavier.

Table VI gives considerable data regarding the strength and other properties of Manila rope. The strengths are in accordance with Navy Department specifications and are generally somewhat lower than average strength figures for Manila rope furnished by the rope manufacturers. A factor of safety of at least 5 should be used.

Fiber rope is oiled for preservative purposes with a petroleum base oil. The finished rope should show under chemical analysis not over 12 percent of oil.

When ordering Manila rope it is well to call for a medium lay for marine purposes, to specify the circumference and strength and to require the ends of the rope to be whipped in such a manner as to prevent the unlaying of the rope when in use.

Some of the smaller ropes or "fittings" called for in ship specifications are apt to give more trouble in the determination of just what is required than the larger and more important ropes; and as they will be referred to later it will be well to define them here. They are almost always tarred and when ordered are understood to be tarred unless otherwise called for.

Houseline is a three thread hemp cord bought by the pound and running about 160 feet to the pound.

Marline is a two thread hemp cord which runs about 222 feet, 360 feet and 520 feet to the pound. The medium

Table VII—Bradlee & Co.'s Chain. Pitch, Breaking, Proof and Working Strains

Size of Chain	Dist. From Cen. of One Link to Cen. of Next	Wt. Per Ft. in Lbs., Approx.	Outside Width	D. B. G. Special Crane: Proof Test, Lbs.	D. B. G. Special Crane: Average Breaking Strain, Lbs.	D. B. G. Special Crane: Ordinary Safe Load, General Use, Lbs.	Crane: Proof Test, Lbs.	Crane: Average Breaking Strain, Lbs.	Crane: Ordinary Safe Load, General Use, Lbs.
¼	25/32	¾	15/16	1,932	3,864	1,288	1,680	3,360	1,120
5/16	27/32	1	1⅛	2,898	5,796	1,932	2,520	5,040	1,680
⅜	31/32	1½	1 5/16	4,186	8,372	2,790	3,640	7,280	2,427
7/16	1 5/32	2	1½	5,796	11,592	3,864	5,040	10,080	3,360
½	1 11/32	2½	1 13/16	7,728	15,456	5,152	6,720	13,440	4,480
9/16	1 15/32	3 3/10	2	9,660	19,320	6,440	8,400	16,800	5,600
⅝	1 23/32	4 1/10	2 3/16	11,914	23,828	7,942	10,360	20,720	6,907
11/16	1 13/16	5	2⅜	14,490	28,980	9,660	12,600	25,200	8,400
¾	1 15/16	6 2/10	2 9/16	17,388	34,766	11,592	15,120	30,240	10,080
13/16	2 1/16	6 7/10	2¾	20,286	40,572	13,524	17,640	35,280	11,760
⅞	2 3/16	8⅜	2 15/16	22,484	44,968	14,989	20,440	40,880	13,627
15/16	2 7/16	9	3 3/16	25,872	51,744	17,248	23,520	47,040	15,680
1	2½	10½	3⅜	29,568	59,136	19,712	26,880	53,760	17,920
1 1/16	2⅝	12	3 9/16	33,264	66,538	22,176	30,240	60,480	20,160
1⅛	2¾	13⅝	3 13/16	37,576	75,152	25,050	34,160	68,320	22,773
1 3/16	3 1/16	13 7/10	4	41,888	83,776	27,925	38,080	76,160	25,387
1¼	3⅛	16	4 3/16	46,200	92,400	30,800	42,000	84,000	28,000
1 5/16	3⅜	16½	4⅜	50,512	101,024	33,674	45,920	91,840	30,613
1⅜	3 9/16	19¼	4 9/16	55,748	111,496	37,165	50,680	101,360	33,787
1 7/16	3 11/16	19 7/10	4¾	60,368	120,736	40,245	54,880	109,760	36,587
1½	3⅞	23	5⅛	66,528	133,056	44,352	60,480	120,960	40,320
1 9/16	4	25	5 5/16	70,762	141,524	47,174	65,520	131,140	43,180
1⅝	4¼	28	5½	74,382	148,764	49,588	......	......	......
1 11/16	4½	30	5 11/16	78,733	157,466	52,488	......	......	......
1¾	4¾	31	5⅞	82,320	164,640	54,880	......	......	......
1 13/16	5	33	6 1/16	88,256	176,512	55,504	......	......	......
1⅞	5¼	35	6⅜	94,360	188,720	62,906	......	......	......
1 15/16	5½	38	6 9/16	100,800	201,600	67,200	......	......	......
2	5¾	40	6¾	107,520	215,040	71,680	......	......	......
2 1/16	6	43	6 15/16	114,240	228,480	76,160	......	......	......
2⅛	6¼	46½	7⅛	121,240	242,480	80,823	......	......	......
2 3/16	6½	49½	7 5/16	128,576	257,152	85,750	......	......	......
2¼	6¾	52¾	7⅝	136,080	272,160	90,720	......	......	......
2⅜	6⅞	58¼	8	151,580	303,160	101,053	......	......	......
2½	7	64½	8⅜	168,000	336,000	112,000	......	......	......
2⅝	7⅛	70	8¾	180,544	361,088	120,362	......	......	......
2¾	7¼	73	9⅛	193,088	386,176	128,725	......	......	......
2⅞	7½	76	9½	205,408	410,816	136,938	......	......	......
3	7¾	86	9⅞	217,728	435,456	145,152	......	......	......

weight is most serviceable about a steamship. It is bought by the pound.

Ratline is a hemp rope which ranges in size by three thread intervals from 6 threads, ¾-inch circumference, to 24 thread, 1⅝-inch circumference. It is always designated by the number of threads and comes in coils of 1,200 feet length. The 15-thread ratline, 1¼-inch circumference, is a very usual size. A coil of this rope weighs 90 pounds.

Roundline and hambpoline are three thread hemp cords which run about 92 feet to the pound. They are of opposite twist. They are bought by the pound.

Seizing is made like ratline and designated in the same manner by the number of threads, but it is ordered by the pound. The sizes are 6-thread which runs 58 feet to the pound, 9-thread which runs 40 feet to the pound, and 12-thread which runs 29 feet to the pound.

Spun yarn is made of two hemp threads running about 93 feet to the pound, and of three threads running about 77 feet to the pound. It differs from the other tarred fittings in not having so much twist in the threads or yarns. The 3-yarn variety is usually most serviceable. It is bought by the pound.

Chain

When dealing with chain the principal considerations are the nature of the chain and strength.

The principal chains met with on shipboard are stud link chain and short link or "Crane" chain. The former is used only for anchor chain cables. The type of chain called "Coil" chain is somewhat used; and it has slightly less links per fathom than the crane chain.

Crane chains are of different grades according to the quality of the iron used in them and in some cases according to the shortness of the links, the strongest chains having slightly more links per fathom than those of lower grade.

Standard proportions for stud link chains and suitable strengths for both the stud link and the short link chains of different sizes can be obtained from the classification society rules and tables, and these are values which chain makers have to live up to.

Table VII gives data regarding the short link chain made by Bradlee & Company. This is selected for reference because the proof test and breaking strain of the "crane" chain are for most sizes identical with the proof test and break test required for short link chains by the American Bureau of Shipping. Strength figures of other manufacturers are in some cases higher than those in the table. It will be noted that a factor of safety of 3 is recommended. In other cases this factor is recommended for the "Special Crane" chain and a factor of safety of 4 for the lowest grade of "Crane" chain and for "Coil" chain. The factor to use in any case depends upon the nature of the work. With chain used in a purchase for lifting or moving loads it is desirable to add about ⅓ to the estimated pull on the line for friction.

It is especially desirable that chains around drums or sheaves have short links in order to lie close without risk of bending.

Anchor chain cables of 1-inch or more diameter of iron are usually of stud link chain and where a vessel is classed stud link chains as small as 11/16-inch are called for.

Anchor chain cables 1⅜-inch and over in diameter may be made of cast steel as well as of wrought and welded links, the former having received classification society approval in 1918, and also having stood up well in service.

Blocks

Blocks for marine use should be of substantial construction. The general practice is to use steel blocks with wire ropes and wood blocks with fiber ropes. The latter should be of the heavy, wide mortise, double cross bolted type, with shell of well seasoned ash reinforced with inside iron straps. On small blocks for yachts, etc., the shell is sometimes of lignum vitæ. Wide mortise steel blocks can be obtained for fiber ropes and all gin blocks are of iron or steel. The bushings are selected according to the service; desirable bushings for the different services will be found noted under the respective headings. Blocks can be obtained with a great variety of shackles, hooks, jaws, eyes, eyebolts, etc., to meet the particular requirements of the service. Some general requirements for shipboard use are:

All blocks to have metal sheaves.

All steel blocks and the ironwork of all wood blocks to be galvanized.

Sheaves in all blocks to be suited to the rope or chain. With rope the diameter of the groove at the tread should be 1/16 inch greater than the diameter of the rope.

Upset shackles to have heart thimbles.

Steel blocks are usually specified according to the size of the sheave and wood blocks according to the size of the shell.

With wire ropes it is important that the sheave diameters be of ample size so as not to cause rapid wear of the ropes. The wire rope manufacturers recommend that the sheave diameter be at least 20 times the diameter of the rope and in their catalogs call for considerably larger sizes to suit the differing degrees of flexibility of the ropes. The Navy Department specifications call for 15 diameters or more. In ordinary merchant ship work, rope economy is often sacrificed to convenience, but good practice with wire rope calls for the use of sheaves about 20 times the diameter of the rope.

Wood blocks generally run about 14 inches for 4½-inch circumference fiber rope, 12 inches for 4-inch rope, 10 inches for 3½-inch and 3-inch rope, 8 inches for 2¾-inch and 2½-inch rope, 7 inches for 2¼-inch and 2-inch rope, 6 inches for 1½-inch rope, 4 inches for 1⅛-inch rope, etc.

Sheaves or drums for chains are preferably 30 or more times the diameter of the chain, but this generally cannot be provided for on shipboard.

Where block shackles have to connect to bands, etc., it is important to provide that the shackles and pins are of the proper size.

In services where a purchase is desirable the blocks and ropes have to be considered together and a proper selection made of both. For instance, with the lead off of the upper block and the weight on the lower block, a combination of two double blocks with a becket on the upper one will cause a pull on the rope of one-fourth of the weight, whereas, with a triple upper block and a double lower block with a becket on the latter the pull on the rope will be only one-fifth of the weight. There would of course be an additional pull due to friction in each case.

Accommodation Ladder

Accommodation ladder falls are preferably of fiber rope, for easy handling. With the usual run of cargo ship ladders, 2¾-inch Manila with a 10-inch double block below and a 10-inch triple block above makes a good combination. On some small ladders 8-inch double and single blocks are used with the same size rope. The upper block has a loose hook and no becket; the lower block has a loose front hook and a becket. Graphite bronze bushings are desirable.

Anchor Light

Manila rope 1⅛-inch circumference will usually answer for this, with 4-inch single wood block with regular shackle and graphite bronze bushing.

Awnings

Wire rope for the support of awnings is preferably ⅜-inch diameter, galvanized cast steel, 6 by 19 construction, with ultimate strength as given in Table V.

Dredge Chains

Dredge chains for various operating services are subject to hard usage and should be of the highest grade of short link chain.

(*To be continued*)

Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Propeller Problem

Q. (1171).—I have been following with interest the excellent articles of Admiral Dyson, especially his latest exposition of the propeller problem. In this connection I have come across a difficulty in the solution of the problem of the double ended ferry boat discussed in MARINE ENGINEERING AND SHIPPING AGE, I believe, during the early part of 1921. I cannot give the date as it was cut off in careless clipping.

After having derived the basic I.H.P. and E.H.P. for the 210-foot ferry, the author proceeds as follows:

$v = 12.73$	12.73
$v/V = 0.67$ (12.73/19)	0.789 (12.73/16.14)
Log $A_v = 3.82$	.....
$A_v = 6500$	4093
Log $A_v = 3.15$	.....
$A_v = 1380$	2043
$N_v = 147.9$	147.9
$(1-s) = 0.9135$	0.9135
$s = 0.0865$	0.0865
$\text{I.H.P.}_d = s \dfrac{\text{I.H.P.}A_v}{S A_v} = 1020$	787
$K = 1.36$	$M_r = 1.05$
$\text{I.H.P.}_p = \text{I.H.P.}_d/K = 750$	$787/1.05 = 750$
$10^z = \text{I.H.P.}/\text{I.H.P.}_d = 5.105$	5.105
$Z = 0.73342$	
e.h.p./E.H.P. = for Z, 0.209	

Now, in Dyson's new method, Z_s for $v/V = 0.67$ is 0.4, not 0.67 (which latter is obtained from $Z_s = (A_v - A_v)$. How can the two be reconciled? Again, for $10^z = 5.105$. the log, which gives $Z_p = .708$ and for this e.h.p./E.H.P. is not 0.209. Is this correct?

Lastly, what is M_R? Dyson makes no mention of it.

In an article by Mr. Bates, second trial, Ap. 1921, p. 336, he begins by selecting (e.h.p./E.H.P.)g. Dyson uses e.h.p./E.H.P. Is this correct?

In Dyson's Fig. 2, for values H/B greater than standard, how are the direction lines obtained? Doubling the H/B value shows a corresponding point to be at BC=2/3 original BC. Is this purely accidental?

A. (1171).—The original curves of A_v and A_v were plotted on actual speeds from the trials of a few ships. As Admiral Dyson's investigations proceeded he found that, when the performance of other vessels were applied, inconsistencies in revolutions appeared which could not be accounted for and he saw that some other method of obtaining them was necessary. So instead of using the actual speeds as a basis, a speed ratio was decided upon from actual performances of many vessels and up to the present time has proven to give consistent results. This curve bears no relation to the original curves.

For the Z_p value of 0.708 I can see no reason why the correct reading of e.h.p./E.H.P. should not be 0.209.

M_r was a corrective factor for indicated horsepower and revolutions where the values of e.h.p./E.H.P. and $^v/V$ obtained from the analysis of the estimated or actual performance of a propeller plotted on the cavitation chart showed cavitation existed. This M_r factor is no longer used in these calculations.

By starting with gross load fraction values of (e.h.p./-E.H.P.)g much work is often eliminated, especially when it becomes necessary to design fairly close to the cavitation region, as we are certain at the start that the load fraction e.h.p./E.H.P. of the actual propeller when the value of K is applied will not put the propeller into cavitation.

The fact that doubling the value of H/B decreases the original BC by 2/3 was accidental, also interesting.

Derivation of Resistance Constant

Q. (1174).—On page 641 of MARINE ENGINEERING AND SHIPPING AGE, October, 1922, in the article, "Resistance of Ships to Propulsion," by A. J. C. Robertson, is given the following formula:

$$\text{Resistance constant (C)} = \frac{1.3115\ R}{\Delta^{2/3}\, v^2}$$

Can you indicate to me how the constant 1.3115 in above formula is obtained?

A. (1174).—The resistance constant $(C) = 427.1 \dfrac{\text{E.H.P.}}{V^3 \Delta^{2/3}}$

$$(1)\quad (C) = \frac{427.1\ \text{E.H.P.}}{V} \times \frac{1}{V^2 \Delta^{2/3}}$$

$$(2)\quad \text{E.H.P.} = \frac{R \times V \times 101.33}{33{,}000}$$

Substituting the value of E.H.P. given by equation (2) in equation (1)

$$(C) = \frac{R\ V}{V} \times \frac{101.33}{33{,}000} \times 427.1 \times \frac{1}{V^2 \Delta^{2/3}}$$

$$(C) = \frac{1.3115\ R}{V^2 \Delta^{2/3}}$$

Motorships vs. Steamships

Q. (1175).—I am much interested in the Diesel engine for marine purposes and have been for years. Do you not think our shipbuilders and owners are failing to serve their own best interests by clinging to the steam engine in its various forms? Should they not even in vessels of fair speed and size turn to the Diesel?

A. (1175).—This is too large a subject to handle satisfactorily in this department. The following suggestions are believed worthy of note but are by no means considered to cover the subject.

The Diesel engine is at present essential to and is used successfully in the submarines of all navies. It is used successfully in powers up to 2,000 or 2,500 per unit in many modern cargo vessels. During the past several years a number of large private yachts have been furnished with this type of machinery. Passenger liners 500 feet in length with speeds of 13½ knots and Diesel engines of 6,000 horsepower are under construction. The writer understands that all the large shipbuilding companies of this country are now prepared to furnish and install this type of machinery. This fact of itself testifies to a recognition of its possibilities.

So much for what has been and what is being done. The Diesel engine, while very economical of fuel, while operating with a smaller force of men than other types of machinery and while eliminating the steam boiler entirely except for heating is of great first cost, requires the attention of specially trained engineers, is relatively very heavy and at present is limited in power to units of say 4,000 to 5,000 horsepower. Perhaps we know too little as yet to make comment on the size of the repair bill for this type as compared with that of others.

The selection of the machinery installation for a ship is a matter of careful consideration resolving itself finally into the old question of the return on the investment.

Your attention is invited to the following articles published in Marine Engineering and Shipping Age:

"Cargo Motorship versus Steamship," by Chas. E. Lucke, September and October numbers, 1920.

"Internal Combustion Engines Applied to Propulsion," by John F. Metten and J. C. Shaw, July, 1921.

"Diesel Electric Propulsion," by J. B. Bassett, August, 1921.

"Diesel versus Steam Drive," by J. E. P. Grant, May, 1922.

NEW BOOKS

Burning Liquid Fuel

Reviewed by J. A. Kelley*

Burning Liquid Fuel. By William N. Best. Size, 6 by 9 inches. Pages, 336. Illustrations, 316. New York, 1922. U. P. C. Book Company, Inc.

"Burning Liquid Fuel" purports to be "a practical treatise on the perfect combustion of oils and tars, giving analysis, calorific values and heating temperatures of various gravities with information on the design and proper installation of equipment for all classes of service."

Briefly, the author opens with reminiscences dating back to his earliest experiences in the West in 1887, followed by profuse tables of oil production, taken mainly from Geological Survey reports. In the chapter on atomization, the author states that all burners may be grouped in three distinct classes, *viz.:* "mechanical, internal mixing and external mixing." He then describes the merits of the type of burner manufactured by himself—which is, of course, in the external mixing class, whereby oil at about twelve pounds pressure is fed into a sheet blast of steam at boiler pressure or compressed air. Incidentally, a photograph is included entitled *mechanical burner.* The author claims that "with low pressure or volume air you are limited to the use of light oils, whereas with compressed air or steam as atomizer, you can use any gravity of crude oil, fuel oil, kerosene or tar, which will flow through a one-half inch pipe." The writer checked back to verify that this book came off the press in 1922, yet all marine men know full well that the Shipping Board standard bunker oil is 14-16 Baumé and that all marine installations, except in a few minor instances, are of the mechanical type of atomization. Adaptions of the *Best system* are described, which permit the use of pulverized coal, thereby opening up the opportunity for the economical use of a fuel which otherwise is wasted or inefficiently used. Tables dealing with the quantity of steam lost in atomizing per boiler horsepower hour are conspicuous by their absence.

The chapter on *oil systems* includes many diagrams of typical piping installations for land use with attendant suggestions and directions, together with photographs of fittings used by the author. A description of a centrifugal air compressor, operated by a condensing turbine, is also included, which is recommended for marine use, with the view to eliminating the necessity for additional boiler make-up, which the steam blast requires.

The remainder of the book is devoted to particular installations and usages, including locomotive equipment, stationary and marine boilers, low pressure boilers and hot air furnaces, commercial gas industry, sugar industry, steel foundry, heat treating, malleable iron, grey iron and brass foundry and forge shop practice, boiler manufacturers' furnace, copper industry, enameling, chemical industry, ceramic, lime and cement equipment, dryers, ore roasters, bread and cracker ovens, chocolate industry, oil and tar still, incinerator and glass industry equipment.

Under *Marine Boilers* all that can be found is a rather illegible diagram, on page 94, attempting to show the *Best burner* adapted to a Scotch marine furnace, with no descriptive matter amplifying. The chapters on oil burning in the various lines of industry, enumerated above, are quite replete with diagrams (there are 316 sketches in the book) and the salient points in the several installations are covered, as well as the general claim for the superiority of oil over coal in each case.

Tucked away under the heading of *Modern Forge Shop Practice,* the author digresses into quite an eulogy on oil, the superb fuel, in which he points out that the power of a nation depends on its conservation of oil. He says, "I hope that the heat from this fuel will be tempered by love so that it may be a nation which will use its power for good, governing with righteousness its people and bringing a reign of peace to the world. . . . Unfortunately the World War has created a demand for this fuel in marine service and our government has equipped many boilers on vessels without making any preparations for a change back from oil to coal." The author then becomes quite alarmed over the shortage of fuel oil for the industries, particularly forge shops, and "sees no reason why the Navy should use oil, if this fuel is in such demand by the manufacturers of our country. . . ." (page 218).

After resuming the subject of oil burning in modern forge shop practice, the author again digresses, saying (page 225), "I am well aware that oil in marine service is attractive because of the saving effected in labor, there being no discharging of ashes, as well as the time saved in charging the fuel oil on the vessel as against the time required for loading of coal; and also the advantage of being able to increase the speed of the vessel, the cleanliness and improved sanitary conditions, as well as the fact that this fuel elevates the mind of the fireman, as his duty does not require mere brawn but brains for the scientific burning of oil, and gives him the feeling that though he is housed up in a hot boiler room (much cooler because of the use of oil as fuel), he is 'a man for a' that'." He does admit that two tugs on oil can do the work of three on coal, but seems to disregard the vital economic phase for the merchant marine. "Yet," he continues, "we must consider the use and the many advantages of this fuel for the manufacturers whose products must furnish at least part of the cargo for these vessels, else they will be operated at a loss."

After continuing with his descriptions of oil burning installation, in forge shop practice, the author, on page 227, again harps back to his theme. He says, "the men in marine service will get a new vision also, and, that is—in forging industry—oil is even more attractive than in marine boiler equipment on ocean going vessels because a great deal more labor can be saved in a forge shop than in marine service, to say nothing of the increased output and superior quality of the product from the forge shop. In times of peace oil should be used only upon as few naval boats as possible. It should be used on some vessels, however, owing to the fact that the men should be trained in the art of operating oil burners. It would be well to have the boilers of the vessels interchangeable so that they can readily be changed from coal to oil, and from oil back to coal, for in case of war oil should be used, if possible, on naval vessels. I know there are a large number of merchant vessels now being equipped with oil in order to save labor and avoid strikes. I believe that will only be used temporarily, but I am equally confident that the nation which conserves its ore and gives its manufacturers all the oil they require will be the manufacturing nation of the future."

The reader is almost led to infer that the burners coming

* Naval Architect, Morse Dry Dock and Repair Company, Brooklyn, N. Y.

under the class of "external mixing" have not received much of an ovation on the sea.

The final chapter, on *Combustion Engineering,* points out the dearth of men able to burn fuel successfully and scientifically—of *engineers in caloric,* and also discourses on vocational successes, closing with a reference to the Lincoln Memorial University of Tennessee, which he claims to be the only institution teaching scientific oil burning.

Although the author himself seems to be quite impressed with his literary contribution to the field of oil burning, the book cannot be recommended to marine engineers as having any particular value, nor of containing data for their use not already plentifully supplied in the advertising literature issued by makers of the various types of burners. The text itself is confined to a particular type of burner. Coming from the pen of Dr. Best, who is universally acclaimed as a pioneer and authority on oil burning, the book is somewhat disappointing.

It is to be regretted that the author has treated the marine field with such little notice, for the number of vessels fitted for oil burning and the large number now being fitted or contemplated shows that the marine field is worth consideration by such an authority as the author. In short, the book is an elaborate catalog advertising the author's wares.

LETTER TO THE EDITOR

Explosions on Oil Tankers

On account of the extreme hazard encountered by repair yards in the overhauling and repairs to oil tankers and vessels carrying fuel oil, also on account of the frequent resulting explosions, it becomes necessary to take the utmost precautions to prevent these accidents.

While a frequent examination for gases acts as a precautionary measure against the accumulation of the same, it very often occurs that pipe joints may not be absolutely tight, thereby allowing the escape of gases into the tanks and, in conjunction with the heavy atmospheres of summer time and saturated atmosphere of early spring and fall, the gases accumulate and lie in the extreme corners of these tanks. In other words, the tank may be entirely free from gas on first examination, while final examination may show traces of the same. To minimize the risk involved to the lowest possible point, a change in design of tank tops and bulkheads seems to be the proper point at which to start these precautions.

This change would not require to be radical, but a portable plate about 4 feet by 6 feet, with stud bolts, located near the ends of each tank would help to solve the problem. These plates could be located on the inner bottom tanks, on the sides of summer tanks, top of expansion trunk and on fore and after peak tank bulkheads, or wherever fuel oil, or cargo oil, is carried. The manhole to these tanks can be located in these portable plates and, whenever repairs are required in the tanks, an insistent demand be made that these plates be removed to allow free escape of gases and entrance of fresh air; also to allow an easy exit from same, and for an easier prosecution of the work.

If this is insisted upon by the United States Steamboat Inspection Service and by the classification societies and the underwriters, fatalities and damage will become greatly reduced; this will also result in a lower cost of repairs.

Philadelphia, Pa. H. Fisher, Superintendent, Kensington Shipyard Department, The William Cramp & Sons Ship & Engine Building Company.

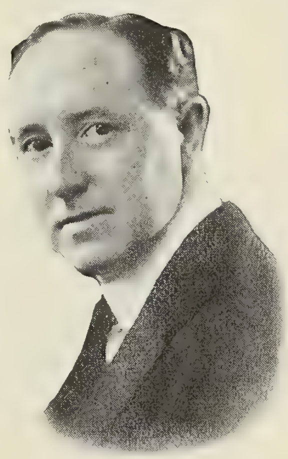
PERSONAL MENTION

William J. Du Bois, recently with the United States Shipping Board at 45 Broadway, New York, has retired from the shipping industry, and will take up his residence at Newport, N. H. Mr. Du Bois has been connected in the marine field for twenty years, having held a chief engineer's license for nearly forty years. His activities and experience have brought him in contact with the operation of marine engines of all kinds in all parts of the world. For twelve years he was superintendent of the American Mail Steamship Company, leaving the employ of this company when its ships were transferred to the Pacific coast. His experience also includes the superintending of construction of the New York city ferryboat *Mayor Gaynor.* During the last five years he has been in the service of the United States Shipping Board, and his retirement will be considered a personal as well as a business loss to the New York division of the Shipping Board.

Wm. J. Du Bois

Captain Eugene E. O'Donnell, of Boston, Mass., has been elected American director of the International Shipping Service Federation.

H. Jasper Cox, recently appointed principal surveyor for Lloyd's Register of Shipping in Japan, began his career in shipbuilding in 1900 when he became an apprentice at the works of Swan, Hunter and Wigham Richardson, Wallsend-on-Tyne. During his apprenticeship he pursued his professional studies at Armstrong College of the University of Durham, and in 1907 at the Royal Naval College, Greenwich. In 1909 he was appointed a surveyor on the chief ship surveyor's staff of Lloyd's Register of Shipping, London, where for six years he was principally engaged in examining survey reports and construction plans of all types of vessels. In 1915 he came to the United States to perform similar work, and in 1916, when the American committee of Lloyd's Register was formed, he was appointed assistant to the chief surveyor for the United States and Canada. In 1920 he became acting principal surveyor on the chief ship surveyor's staff and proceeded to Japan to open an office for the approval of plans for vessels building and to be built in Japan and other countries of the Orient. While in Japan he helped establish the Japanese Committee of Lloyd's Register with Mr. K. Uchida, member of the House of



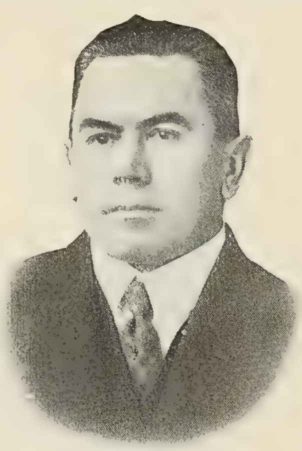
H. Jasper Cox

Peers, as chairman. Early in the present year he returned to this country to resume duties as assistant to the chief surveyor. On December 12 he will sever connections here and within a few months take up his new duties as principal surveyor for Japan.

W. J. Love, vice-president and general manager of the Emergency Fleet Corporation, has been placed in full charge of the North Atlantic District of the Emergency Fleet Corporation and the United States Shipping Board with headquarters in New York city. He will continue as vice-president of the Emergency Fleet Corporation, and will have in charge the management of the New York organization and supervision on behalf of the Board of the operation of all its passenger lines. Mr. Love came to the Fleet Corporation in July, 1921, recognized as one of the ablest traffic and shipping men in America. For sixteen months he has served as vice-president and trustee of the Emergency Fleet Corporation, being associated with President Smull in charge of the operation of the Government's fleet. With the combined experience of private practice and that gained in the operation of Government ships, Mr. Love will be particularly qualified to take charge of the Shipping Board's broad interests in New York.

W. J. Love

Louis R. Ford, who has just been appointed manager of the Diesel engineering department of the Morse Dry Dock and Repair Company, Brooklyn, N. Y., served in the United States Navy for 17 years. During this time he was assigned to special engineering duty by the Secretary of the Navy, in connection with Diesel engine work. During the war he was in charge of the maintenance of submarines operating along the Atlantic coast. In 1919 he resigned from the Navy as a lieutenant commander and accepted a position with the Worthington Pump and Machinery Corporation as consulting Diesel engineer. He resigned from this connection with the Worthington Corporation on November 30 to assume his new duties with the Morse company.



Louis R. Ford

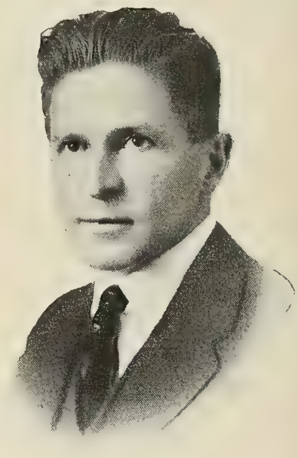
W. B. Keene, formerly assistant to W. J. Love, has been elected a trustee of the Emergency Fleet Corporation, and will assume management of the traffic department in the Washington office.

Carlos de Zafra, president of Seabury and De Zafra, Inc., consulting naval architects and marine engineers, has been appointed to the engineering faculty of the New York University in connection with the new Russell Sage Research Laboratory of Mechanical Engineering. He will conduct lectures on power plant engineering and carry out tests on various installations of steam, oil and electric machinery. Professor de Zafra will continue his service as a consulting marine engineer with headquarters at New York University.

H. F. Alexander was re-elected president of the Pacific Alaska Navigation Company, holding company for the Pacific Steamship Company (the Admiral Line), at the annual directors' meeting.

C. N. Wonacott, vice-president and secretary of the Atlantic, Gulf and West Indies Steamship Company has resigned to become vice-president of the Multomah Lumber and Box Company, Portland, Ore.

H. W. Parsons, formerly with the marine department of the General Electric Company, has recently joined the marine department of the Power Specialty Company to handle the well known Foster boilers and superheaters. A native of California, Mr. Parsons was first associated with the Bay Counties Power Company. He later joined the marine department of the Southern Pacific Company of California, leaving that company to act as sales engineer for a number of marine contractors. In 1911, he joined the turbine department of the General Electric Company and was transferred to the marine department of that company at the outbreak of the war. In December, 1921, Mr. Parsons left that company to take charge of the New York office of John R. Proctor, Inc., constructing engineers, leaving there in October, 1922, to become associated with the Power Specialty Company.



H. W. Parsons

John M. Born has been appointed agent for the intercoastal service of the United American Lines at Atlanta, Ga., with offices at 1108 Candler Building.

George G. Browne, formerly surveyor for the American Bureau of Shipping at Havre, France, has been appointed exclusive surveyor for that organization at Panama.

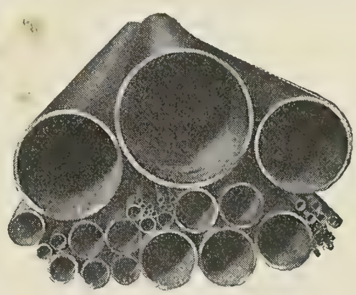
Lynn W. Nones, formerly with the Griscom-Russell Company, has been appointed eastern manager of the marine department of the Diamond Power Specialty Corporation with offices at 90 West street, replacing F. W. Leahy, who lately resigned.

E. B. Sadtler, formerly with the Oscar Daniel Shipbuilding Company, is now affiliated with the Peabody Engineering Corporation, New York.

William T. Donnelly, consulting engineer, New York, delivered an illustrated lecture on "Safety First on Our Harbor Waters" before the Staten Island Chamber of Commerce at the Curtis Annex Auditorium, Port Richmond, New York, on Thursday evening, November 2.

H. J. Finch, assistant to James Sinclair, Far East and Africa traffic manager for the Shipping Board, has resigned to join A. H. Bull and Company, as manager of its West African service.

Gilbert W. Yarus, until recently chief fuel inspector at the New York office of the United States Shipping Board, is now in charge of the bunkering department of the Seiler Coal Company, Inc., of 90 West street, New York.



Marine Engineering
And Shipping Age

Vol. XXVII **DECEMBER, 1922** **No. 12**

Aldrich Publishing Company
in conjunction with
Simmons-Boardman Publishing Company
Woolworth Building, New York, N. Y.

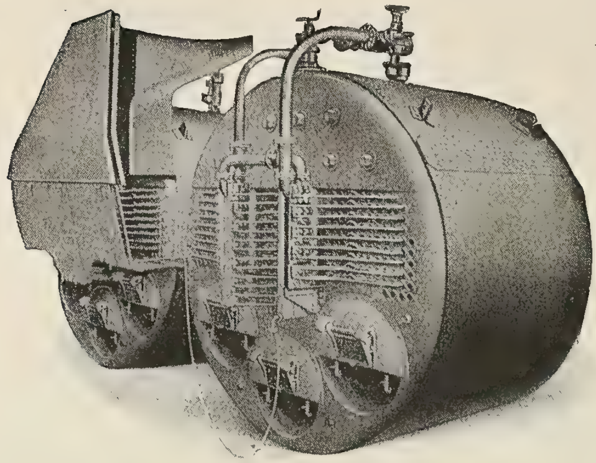
EDWARD A. SIMMONS, President — HENRY LEE, Vice-President and Treasurer — ROY V. WRIGHT, Secretary
GEORGE SLATE, Business Manager

CINCINNATI: First National Bank Building
CHICAGO: Transportation Building
CLEVELAND: 4300 Euclid Avenue

BOSTON: 294 Washington St.
WASHINGTON: Home Life Building
NEW ORLEANS: Maison Blanche Annex

LONDON, England: 34 Victoria St. Westminster, S. W. 1.
Cable address: Urasigmec, London

Subscription price, United States, Mexico and Canada, $3; foreign, $4. Foreign subscriptions may be paid through our London Office, 34 Victoria Street, S. W. 1.



How you can make Four Boilers do the work of Five

A BATTERY of four Todd Elesco Superheater Boilers replaces five boilers in which superheater equipment is not included.

That is not a guess. It's a fact. We figure it on that basis when an owner gets tired of wasting one-fifth of all his coal and orders Superheaters installed while his ship's in port.

Get these figures. The saving in coal runs better than 10% for quadruple expansion engines, 12% for triple expansion engines, and 18% in compound engines using Todd Elesco Superheater equipment, as against the cylinder condensation losses which go with the old-fashioned use of saturated steam.

There are close to 3000 vessels equipped with *Todd Elesco Type Superheaters*—so our figures are based on a tonnage of over 3½ million indicated horse power.

With Todd Elesco Superheaters on oil burners you get such figures as .913 lbs. of oil per I.H.P. hour (S.S. Eastern Ocean); .921 lbs. of oil I.H.P. hour (Eastern Cloud); 11 knots per hour on 220 lbs. of oil in 24 hours (S.S. Robin Adair), and so on.

Todd Shipyards are in business to increase the efficiency of American shipping. This is one of our several economy gaining steam specialties.

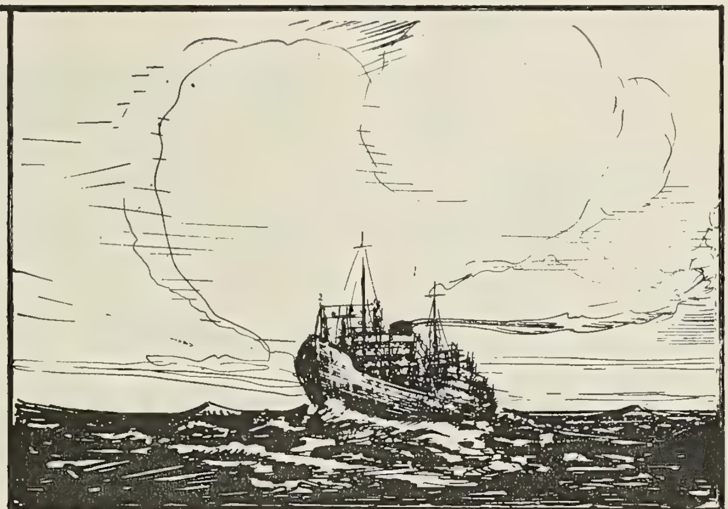
If you want to know how to get more space for revenue cargoes, how to cut your coal bill about 20%, how to make four boilers do the work of five—ask us to send you full data on Todd Elesco Superheaters.

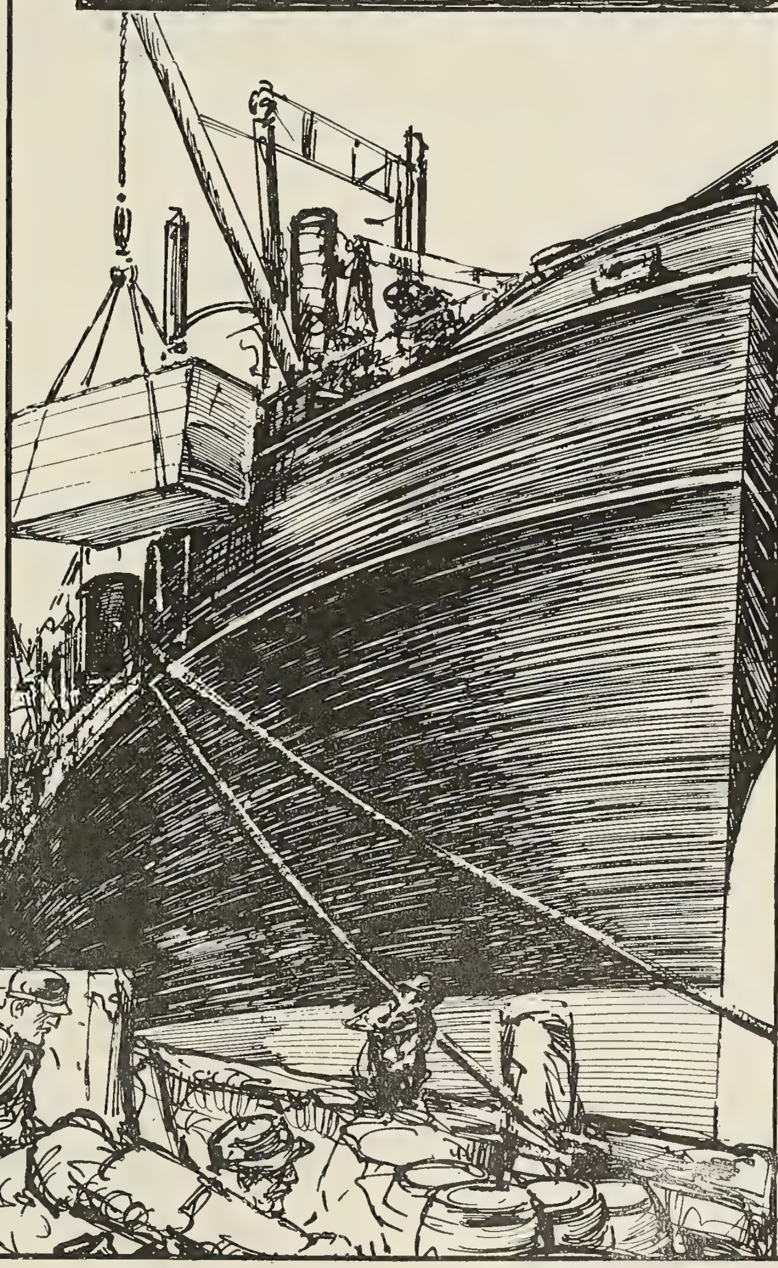
TODD
NEW YORK, U.S.A.

TODD ELESCO SUPERHEATERS

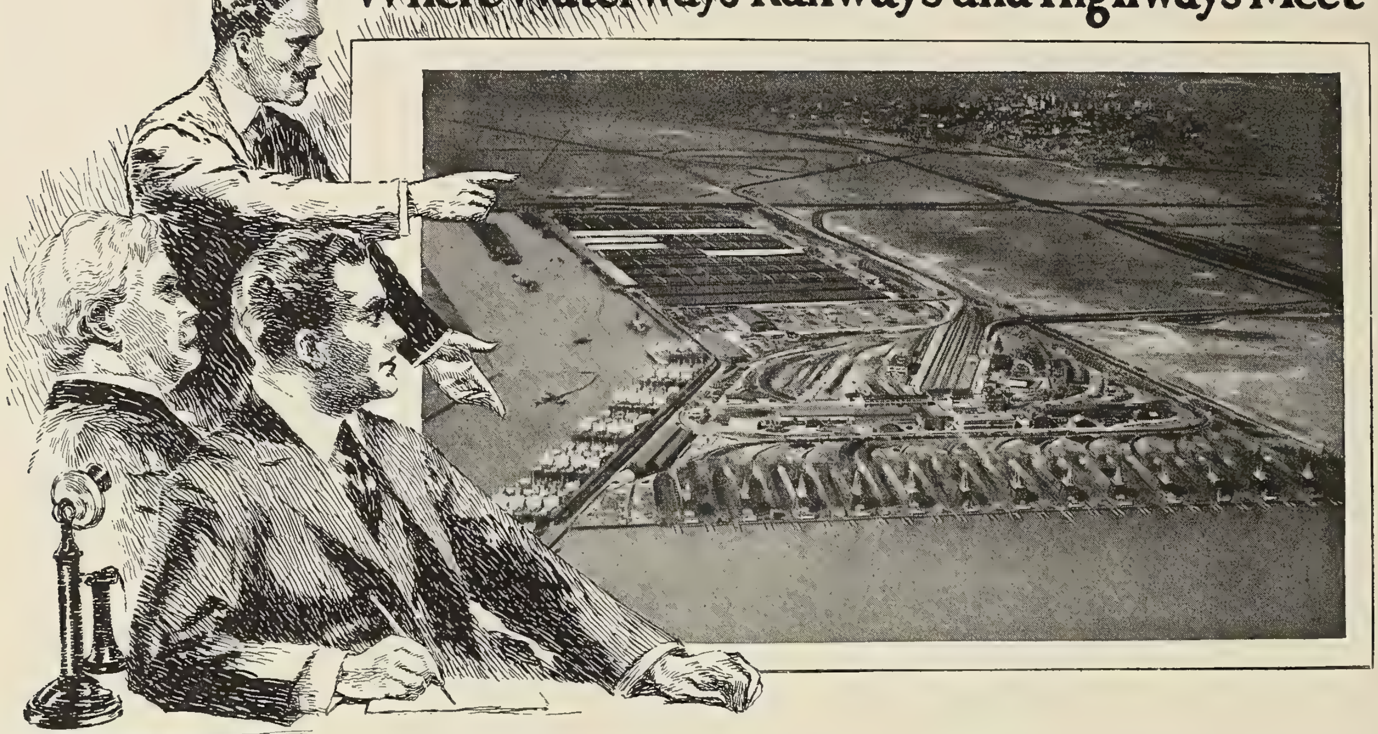
Licensed by The Superheater Company under Schmidt and other Patents

TODD SHIPYARDS CORPORATION 25 Broadway, New York





Where Waterways-Railways and Highways Meet



PORT NEWARK

THE MIRACLE OF MODERN TIMES

Most shipping and factory centers have grown up without planning. We see evidence of this during normal times in port congestion, in shortage of storage and loading and unloading facilities.

We also see factories located on expensive land, or too far from primary markets, or inconvenient for employees to reach and often lacking proper railway connections.

Port Newark is a correctly and scientifically planned shipping terminal and industrial center. On the New Jersey mainland, a part of the Port of New York, it is nearer lower New York Bay than Manhattan Island is. Seven trunk line railroads connect with its belt line railroad.

At Port Newark rail-to-ocean steamship delivery becomes an actuality on the Atlantic seaboard. There is no lighterage necessary. The channel is 31 feet deep; and an inland ship canal 7,000 feet long and 650 feet wide will have a ship turning basin at its end.

Three railroad classification yards are nearby. Three heavy duty roadways connect with the Lincoln Highway and other main trucking thoroughfares. Newark is ten minutes away, and New York is reached in twenty minutes by truck.

Ten million people live within fifty miles of Port Newark, the biggest market in the world. Labor supply is plentiful and diversified, the labor population is over 200,000. Newark and its suburbs offer comfortable and economical housing for all classes of labor.

Land values are lower at Port Newark. The space you need, the shipping facilities you require are at Port Newark. What will your needs be within the next five years? Write

Thomas L. Raymond, *Director*

DEPARTMENT OF PUBLIC IMPROVEMENTS, NEWARK, N. J.

Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

Bethlehem Corporation Awarded Contract for Construction of Hudson River Line Steamer

THE contract for the construction of a new paddle wheel steel steamer for the Hudson River Day Line has been awarded the Bethlehem Shipbuilding Corporation, on a bid of $742,140. The new vessel, which was designed by J. W. Millard & Brother, naval architects, 17 State Street, New York City, will have an over all length of 338 feet, extreme breadth 76 feet and depth molded to main deck at side of guard 13 feet 8 inches. She will be propelled by a diagonally inclined triple expansion steam engine, steam being supplied by two single and two double-ended Scotch boilers. The steamer is to be furnished complete with the White Fuel Oil Engineering Corporation mechanical fuel oil burning system.

Although first bids were received on October 20, the date of delivery of the new boat was postponed until April 1, 1924, and a second set of prices requested. The tenders submitted were as follows:

	First Bid	*Second Bid*
Federal Shipbuilding Co.	$695,000	$695,000
Bethlehem Shipbuilding Co.	742,140	742,140
Sun Shipbuilding Co.	815,254	815,254
New York S. B. Co.	980,000	959,000
Bath Iron Works	1,030,000	980,000

Contract for Construction of Red "D" Line Ship Awarded to New York Shipbuilding Corp.

THE New York Shipbuilding Corporation has been awarded the contract for the construction of a new passenger and freight ship for the Red "D" Line, bids for which were taken several weeks ago. The vessel will be driven by turbine engines and was designed by Theodore E. Ferris, naval architect and marine engineer, of 30 Church Street, New York City.

The tenders offered contained about 44 proposals, which included prices for the ships equipped with McIntosh & Seymour engines, Busch-Sulzer engines, Burmeister & Wain engines and the Sun-Doxford engines. The types of turbine engines figured on included the De Laval, Parsons, Curtis and Westinghouse makes. In addition to the 44 bids, proposals were made by each shipbuilder to construct one and two ships on the Isherwood system, stating the saving in weight and price.

The ship is to have an overall length of 320 feet and will be of the two-deck shelter deck type driven by twin screws and will be equipped to carry about 50 first class and 25 second class passengers. The vessel will be built to American Bureau Classification. Bids submitted were as follows:

Company	Reciprocating Engines — Price each for — One ship	Two ships	De Laval Turbines — Price each for — One ship	Two ships	McIntosh & Seymour Diesel Engines — Price each for — One ship	Two ships
Federal Shipbuilding Co.	$753,700	$723,700	$789,000	$765,000	$879,000	$849,000
New York Shipbuilding Corp.	740,000	740,000	798,000	798,000	852,500	852,500
Bethlehem Shipbuilding Corp.	781,000	756,000	831,000	811,000	910,000	890,000
Todd Shipyards Corp. (Tacoma Yard)	793,000	754,000	854,000	808,000	922,000	892,500
Newport News Shipbuilding Co.	863,000	829,000	901,000	871,000	959,000	930,000
Merchant Shipbuilding Corp.	889,000	839,000	926,000	874,000	974,000	924,000
Wm. Cramp Sons Ship & Engine Bldg. Co.	906,000	871,000	948,000	912,000	*1,099,000	*1,064,000
Sun Shipbuilding Co.	910,000	870,000	946,000	906,000	986,000	946,000
Bath Iron Works	1,097,000	1,045,500	1,131,000	1,079,500	1,170,000	1,121,000

*Burmeister & Wain engines.

Federal Shipbuilding Company Gets Contract for Construction of Two 262-Foot Diesel Propelled Ships

IT is reported from authentic sources that the Federal Shipbuilding Company, Kearny, N. J., has been awarded the contract for the construction of two Diesel propelled ships for the United States Steel Products Company. The boats will be of the full Welland Canal size and will probably be operated through the canal in the open season and in Southern waters in the winter time. It is understood the total cost will be close to $1,000,000.

The vessels will each be 262 feet over all, length 250 feet on the keel, 43 feet beam and 20 feet deep. They will be equipped with Diesel oil burning engines and electric hoists.

Sun Company to Convert Covedale to Diesel Drive

THE Sun Shipbuilding Company has been awarded the contract for reconditioning the Munson Line steamer *Covedale.* The steam engine in the ship is to be replaced with one 900 brake horsepower, 6-cylinder, 4-cycle McIntosh & Seymour Diesel engine and the auxiliaries are to be electrically driven instead of by steam. A small auxiliary boiler will supply steam for heating purposes, the contract to be completed in about 75 days. It is understood the total cost will be close to $130,000.

Fletcher Yard Lowest Bidder for Resolute

WITH a price of $99,973, the W. A. Fletcher Company, Hoboken, N. J., submitted the lowest bid for the work of reconditioning the steamship *Resolute,* of the United American Line. The tenders were opened November 21, with the following results:

Fletcher	$99,973
Robins	146,200
Tietjen & Lang	149,780
Morse	172,560
Newport News	182,000

Bids Asked for Ten Steel Barges for Rock Island

UNITED States Engineer Office, Rock Island, Ill., will receive bids until 10 A. M., December 11, for the construction and delivery of 10 steel barges. The vessels are to have a length of 100 feet, beam molded 30 feet and depth molded 6 feet. The deck fittings will include four 36-inch cleats, four 7-inch double bitts and four 30-inch open chocks, all of cast steel. The bids are to be delivered afloat at a port on the Mississippi River between Dubuque and Keokuk, Iowa.

Alderton Dry Docks Gives Lowest Price for Liberty Job

THE Alderton Dry Docks Company tendered the lowest bid for the work of repairs to the steamship *Liberty.* Prices were received by the Shipping Board, 45 Broadway, New York, on November 22, as follows:

Alderton	$12,290
N. Y. Harbor	13,653
Staten Island	14,633
Atlantic Basin	17,200
Robins	18,565

Tide Water Oil Co. Plans Three New Steel Barges

PLANS and specifications have been issued by the Tide Water Oil Company, 11 Broadway, New York City, for the construction of one, two and three steel barges, of the scow type, each having a capacity of 300,000 gallons of bulk oil.

The proposed boats are to have a length, inside fenders, of 162 feet; breadth, inside fenders, 36 feet; depth molded, amidships, 10 feet; draft, molded, 9 feet 6 inches. Each boat will have a continuous steel, watertight bulkhead fitted on the center line for the full length of the oil tanks and there will be five oil tight transverse bulkheads. The hatches are to be fitted in groups of four, one forward and one aft. A deck house, about 16 feet by 12 feet by 7 feet three inches, will be located aft, built of 7½ pound plating. It will be equipped with four galvanized pipe berths, shipmate range, etc., the living quarters to be provided with all necessary fittings.

Equipment

A three-inch hand force pump of approved make will be fitted in each compartment, with 2-inch bilge suctions.

Cast iron fittings to be supplied include the following: four 9-inch towing bitts; six open chocks; six heavy mooring cleats; two Providence hand power capstans.

There are also to be furnished one 650-pound stockless anchor; 45 fathoms of ¾-inch chain cable; 45 fathoms of ¾-inch wire hawser; one 14-foot wooden workboat.

Cargo Pump

There is to be one pump, 14 by 10½ by 18 inch horizontal duplex, of approved make, capable of discharging 750 barrels per hour when operating at a piston speed of not over 85 feet per minute with a working steam pressure of 100 pounds per square inch.

Heater Coils

The coils in each compartment are to consist of a coil or grid about 50 feet long, and a length of pipe in every frame space for full width of compartment.

Engineer Office at Pittsburgh to Have New Dredge

UNITED States Engineer Office, Pittsburgh, Pa., will receive sealed proposals until 12 o'clock noon (Eastern time), December 1, for constructing and delivering one steel dipper dredge hull afloat at Pittsburgh. The hull will have a molded length of 100 feet, molded beam 34 feet, depth forward above base 6 feet 8 inches, depth aft above base 6 feet 8 inches.

After delivery of the hull, the contracting officer will furnish and install all machinery, boiler and stack; dipper, complete with "A" frame; boom and back stays; spuds; all sheaves; planking for top of deckhouse; operator's house and skylight over boiler. The vessel will be built to the rules of the American Bureau of Shipping and the longitudinal system of framing will be used.

One approved syphon, with 2-inch discharge, will be installed in each compartment, the contractor to furnish and install all necessary piping, valves, fittings, etc.

Two Diesel-Electric Drive Ships Proposed for Great Lakes; Lombard Governor Co. Gets Engine Contract

THE Minnesota Atlantic Transit Company, of Duluth, Minn., is contemplating the construction of two Diesel electric drive vessels, according to reports from the Great Lakes district. Henry Penton, of Cleveland, Ohio, is the naval architect preparing plans and specifications.

It is understood that the Lombard Governor Company, of Ashland, Mass., manufacturers of Lombard oil engines (Diesel system), has been awarded the contract for four 6-cylinder 375 horsepower Diesel engines and two 2-cylinder 60 horsepower auxiliary engines for the proposed vessels. Information as to who will build the ships was not obtainable at this time.

French Company Adopts Oil Fuel for Its Ships

THE Compagnie des Messageries Maritimes owns a certain number of oil-burning ships and has decided to make further use of oil as a vessel-fuel, according to information received by the Department of Commerce, Washington, D. C., from the American Consul at Marseilles, France. The ships of this company include the *Lieutenant de Missiessy* and the *Lieutenant de La Tour*,—the former built in England and the latter in America; and a steamboat, the *Angkor*, refitted at La Ciotat in 1921. Another vessel, the *Amazone*, will be refitted in a short time. Two large boats under construction, *Leconte de Lisle* at La Ciotat and the *Aramis* at the shipyard of La Gironde, will be oil-burners; as will all ships built for this company in the future. However, the equipment of the vessels will be so arranged that the substitution of coal may be easily effected in case the price of oil becomes prohibitive.

The Compagnie des Messageries gives the following advantages derived by vessels from the use of oil as fuel: (1) reduction of crews, (2) regularity in power and thus in speed, (3) reduction in expense of boiler maintenance. It is stated that experiments prove that when oil is substituted for coal as fuel on vessels, the boilers give much longer service.

Four Contracts Awarded to the Johnson Works

THE Johnson Iron Works, of New Orleans, La., was awarded the contract for installing Falk gears and overhauling the machinery of the steamship *West Wauna*, new bids for which were recently taken by the United States Shipping Board. The prices submitted were as follows:

Johnson Iron Works	$24,400
Galveston Dry Docks	25,907
Todd D. D. & S. B. Co.	25,969
Jahncke Dry Docks	26,942
Alabama D. D. & S. B. Co.	29,000

The Johnson Works was also the successful bidder for the contract to furnish and install a new shaft on the stern wheel river tug of the Mississippi-Warrior service, at an approximate price of $4,000.

Other awards made to the same company include the work of installing new plates in the turbine and minor repairs to the turbine auxiliaries on the steamship *West Sequoia;* and the making of repairs on the steamship *El Demar,* including the shortening of masts and minor repairs to machinery and piping.

Bids Asked for Building of Three Steel Deck Barges

UNITED STATES Engineer Office, Pittsburgh, will receive sealed proposals until 12 o'clock noon, Eastern Time, November 25, for furnishing and delivering three steel deck barges. The boats are to have a molded length of 120 feet, molded beam 32 feet, molded depth 7 feet, depth of hull at center 7 feet 4 inches.

Each barge is to be symmetrical about the centerline, wall sided, flat bottomed, with rounded bilge, without shear, and deck pitched 4 inches between the centerline and gunwale. There are to be two transverse watertight collision bulkheads, one longitudinal watertight centerline bulkhead and one transverse watertight bulkhead. The deck fittings will include six cast steel watertight hatches, four cast steel towing bitts; four cast steel kevels, not less than 46 inches in length and suitable for a 2-inch rope.

United States Ship Houston Is to Be Converted to Oil

THE Hanlon Shipbuilding and Dry Dock Company, of Oakland, Cal., was low bidder for reconditioning the *U. S. S. Houston*, with a tender of $20,468. The work called for converting the vessel from coal to oil-burning, in addition to other changes, to be completed in 28 days. The following companies submitted bids, which were:

Bethlehem Shipbuilding Co.	$26,638
Los Angeles Shipbuilding Co.	27,359
Main Iron Works	30,088
United Engineering Co.	32,986
General Engineering Co.	36,014
Moore Shipbuilding Co.	40,125

Bids in for S. S. Swiftstar Repairs; Newport News Low

THE Newport News Shipbuilding & Dry Dock Company has been awarded the work of reconditioning the Steamship *Swiftstar*, of the C. D. Mallory Company, tenders for which were opened on November 8.

The bids were as follows:

Newport News	$171,500	60 days
Robins	198,000	75 days
New York Harbor	251,600	80 days
Morse	295,000	80 days
Crane	381,920	90 days

The City of Los Angeles left on her first trip from Los Angeles to Honolulu, September 11th. Upwards of three hundred members of the Los Angeles Chamber of Commerce with their wives and families were on board. The service is to be fortnightly, sailing from Los Angeles and from Honolulu every second Saturday from September 23rd until further notice.

Seven Steel Barges, Two Boilers, Two Turbines, Pumps and Equipment Wanted By War Department, Memphis

THE War Department, Office of the Mississippi River Commission, for the First and Second District, of Memphis, Tenn. (Flood Control, Mississippi River), has issued specifications for the construction of six and seven steel barges and the furnishing of turbines, pumps, feed-water heater, boiler feed pumps, electric light plant and boilers, sealed proposals to be received at the office of the Commission, Customhouse, Memphis, Tenn., until 11 A. M., December 2.

Barges

Prices are to be submitted for six and seven steel barges, each to have a molded length of 120 feet, beam 30 feet, depth of hold at center 7 feet 4 inches, beam 30 feet, depth of hold at side 7 feet. There are to be four continuous transverse watertight bulkheads, and each barge is to be equipped with ten hatches and two towing bitts at each end.

Boilers

The work contemplated by the boiler specifications consists of furnishing two horizontal internally fired boilers of the Clyde or dry-back type without steam dome, fitted with Morison corrugated furnace, or equal, grate bars, firebrick-lined combustion chambers, dry pipes and compound separators. Each boiler shall be of 125 horsepower and have not less than 1,250 square feet of heating surface, the furnace not less than 48 inches in diameter, grate surface not less than 28 square feet and flues of not less than 3½ inches in diameter and each provided with a hydrokineter. They are to be designed for a working pressure of 200 pounds per square inch.

It is proposed to erect the boilers side by side on suitable saddles, the saddles to be furnished by the contractor and constructed to conform to the crown of the deck.

Turbines

Two steam turbines, each direct-connected to a 4-stage centrifugal pump, complete with flexible couplings, shall be furnished and installed, and each turbine and pump shall be mounted on a cast iron base. The steam turbine shall be designed to run condensing in conjunction with one waterworks type surface condenser and air pump of sufficient capacity to handle all the exhaust steam from both turbines. Each steam turbine shall be designed to operate on 150 pounds gage pressure at the throttle, with 26-inch vacuum at the exhaust nozzle, at a speed of not more than 2,000 revolutions per minute.

Pumps

The pumps shall be the horizontal shaft, 4-stage centrifugal type, adapted to the speed of the turbine, and shall be designed to deliver 750 gallons of water per minute, each, against a pressure shown by suitable gage attached to the discharge nozzle of 225 pounds per square inch. The suction lift will be approximately 10 feet.

Condenser

The condenser, designed to be installed in the suction line to the pump, will have not less than 600 square feet of tube surface.

Twelve Contracts for Repairs Go to N. Y. H. Yard

THE contract for repairs to the steamship *Nile* was awarded to the New York Harbor Dry Dock Company, following the opening of bids, November 10, by the Shipping Board, at 45 Broadway. Prices submitted:

New York Harbor	$4,533
Alderton	5,279
Clinton	5,347
Crane	6,439

Tenders were opened by the Board on the same day for repairs to the steamship *Sarcoxie*, which was also awarded the New York Harbor Dry Dock Company on their bid of $1,135.

The steamers *Westport* of the Shipping Board, *Cosmos* of the Ellerman Lines, *Sapanta* of the Standard Transportation Company, oil barge *No.* 5 of the Tidewater Oil Company, *West Gotomska* of the Shipping Board, *Somerset* of the Standard Oil of New Jersey, *Argen* of the Standard Oil of New York, *Castle Lodge* and *Westerner* of the Shipping Board and a sub chaser of Sloan Danenhauer, are also recent contracts awarded the New York Harbor Dry Dock Company and not the Staten Island Shipbuilding Company, as previously reported.

Steamer, Barge and Terminal Construction Program in Hands of Philadelphia Engineering Firm

Chapman and Fisher Company, Inc., Preparing Plans and Specifications for River Passenger Steamer, Ferryboats and Barges in Addition to Three Piers

THE construction of a new passenger steamer, two ferryboats, several tank barges and rebuilding of other tank barges for Chesapeake Bay service, in addition to the construction of two 700-foot covered piers and a coaling pier, are among the latest propositions on the boards of Chapman & Fisher Company, Inc., consulting engineers and naval architects, 524 Walnut Street, Philadelphia, Pa.

The firm recently opened bids for rebuilding the passenger steamer *New Jersey*, for service on the Delaware River, for the account of the Burlington Island Amusement Company. The prices submitted for the work were $119,500; $177,000; $210,000; $273,000.

New Construction

The new vessel proposed is to be a first-class passenger excursion steamer having a length of 240 feet, 35 feet beam, 60 feet over guards and 12 feet deep. She is to be driven by compound inclined engines. The speed is to be about 14 knots.

The dimensions for the two ferryboats have not yet been determined and probably will not be available for about 60 days. The boats will be for service to Delaware River ports.

With regard to the construction and rebuilding of tank barges, which will be for Chesapeake Bay service, details were not available at this time although plans and specifications are expected to be completed in December.

Pier Work

The Chapman & Fisher Company have also taken over a proposition to engineer and construct a water terminal along the Atlantic Seaboard, probably a South New Jersey port. The plan is to build two 700-foot covered piers for the storage of grain, package freight and bulk oil and also to construct a coaling pier. Considerable dredging and wharf building will be involved in the terminal project. The matter is expected to be in sufficient detail to secure bids on this work early in February and a meeting of the stockholders, controlling the operation, to determine the extent of expenditures, is arranged for late in November.

198 Steel Vessels of 255,431 Gross Tons Under Contract Oct. 1, Increase Shown Over September

ON October 1, 1922, American shipyards were building or under contract to build for private shipowners 198 steel vessels of 255,431 gross tons compared with 131 steel vessels of 249,999 gross tons on September 1, 1922.

These figures do not include Government ships or ships building or contracted for by the United States Shipping Board.

Following is a summary of reports of shipyards to the Bureau of Navigation, Department of Commerce, showing the number and gross tonnage of steel vessels under construction or contract for private owners on October 1, 1922:

Companies.	Number.	Gross tonnage.
American Bridge Co., Ambridge, Pa	79	36,082
The American Shipbuilding Co., Cleveland, Ohio	7	53,000
Bethlehem Shipbuilding Corp., Ltd.:		
Baltimore Dry Docks Plant, Locust Point, Baltimore, Md	2	2,020
Harlan Plant, Wilmington, Del	5	2,736
Sparrows Point Plant, Sparrows Point, Md	3	17,550
Union Plant, San Francisco, Calif	2	......
Charles Ward Engineering Works, Charleston, W. Va	5	1,400
Consolidated Shipbuilding Corp., Morris Heights, N. Y	1	300
Dravo Contracting Co., Pittsburgh, Pa	20	6,690
Dubuque Boat and Boiler Works, Dubuque, Iowa	2	275
Federal Shipbuilding Co., Newark, N. J	5	18,500
Great Lakes Engineering Works, River Rouge, Mich	3	16,820
Howard Shipyards Co., Jeffersonville, Ind	2	995
James Rees & Sons Co., Pittsburgh, Pa	1	175
Johnson Iron Works, Dry Dock and Shipbuilding Co., New Orleans, La	2	750
Kyle & Purdy, Inc., City Island, N. Y	3	810
Los Angeles Shipbuilding and Dry Dock Corp., Los Angeles, Calif	2	3,500
Marietta Manufacturing Co., Point Pleasant, W. Va	11	4,050
Nashville Bridge Co., Nashville, Tenn	3	1,000
Newport News Shipbuilding and Dry Dock Co., Newport News, Va	3	13,000
New York Shipbuilding Corp., Camden, N. J	10	30,690
The Pusey & Jones Co., Wilmington, Del	4	8,300
Riter-Conley Co., Pittsburgh, Pa	10	9,000
Staten Island Shipbuilding Co., Port Richmond, N. Y	5	2,738
Sun Shipbuilding Co., Chester, Pa	3	13.650
Toledo Shipbuilding Co., Toledo, Ohio	1	8,200
Wm. Cramp & Sons Ship and Engine Building Co., Philadelphia, Pa	3	2,100
Union Construction Co., Oakland, Calif	1	1,100
Total	198	255,431

Contract Award

The contract for the construction of three steel dump scows, bids for which were opened November 7, by the United States Engineer Office, Buffalo, N. Y., has been awarded the Penn Bridge Company, Beaver Falls, Pa. The company's price was $92,120.

Bunkering Ship Contracted for at New Orleans, La.

IN order to take care of their steadily increasing business, the Consolidated Fuel Company, Inc., of New Orleans, La., has contracted with the Johnson Iron Works, of that city, for the construction of a steel collier hull, 110 feet by 35 feet by 6 feet 6 inches, for delivery early in 1923. The boilers and conveyor machinery are to be furnished and installed by the owner. The contract price for the hull and tower was $25,300 and the total investment will probably be about $50,000. The latest type machinery will be installed in the vessel and she will be able to deliver coal at the rate of 200 tons per hour.

The Consolidated Fuel Company, Inc., was organized in February of this year with Mr. H. E. McCormack, President, R. P. Hyams and H. C. Whiteman, Vice-Presidents, and Charles Harrington, General Manager. Mr. I. B. Whiteman, for many years engaged in the bunkering of ships at New Orleans has recently become associated with the company in the capacity of marine superintendent.

Proposals Asked for Construction of Nine Barges

SEALED proposals will be received at the office of the Mississippi River Commission, Third District, P. O. Box 404, Vicksburg, Miss., until 11 A. M., December 14, for furnishing nine steel barges. Each boat will have a length molded of 120 feet, beam molded 30 feet, depth of hold at center 7 feet 4 inches, depth of hold at side 7 feet.

Each barge shall be of steel construction throughout, flat-bottomed, with rounded knuckles, wall sided, symmetrical about the center line, with a rake 15 feet long, a sheer 12 inches high at each end, and a crown of beam of 4 inches. Transverse framing lines shall be spaced uniformly 30 inches. There shall be four continuous, transverse, watertight bulkheads, one non-watertight longitudinal plate bulkhead over the center line, and two symmetrically disposed longitudinal stiffening trusses.

Bethlehem Buys Simpson's Patent Dry Dock Company

THE Bethlehem Shipbuilding Corporation has purchased the plant of the Simpson's Patent Dry Dock Company, whose main office is located at 23 Ames Building, Boston, Mass. The yard is on Marginal street, East Boston. It was established in 1856.

Three graving docks have been maintained, one 465 feet long, one 250 feet long and one 150 feet long. The company's officers were, Charles F. Crowell, president; Ezra H. Baker, vice-president, and Arthur M. Baker, general manager.

It is announced that the drydock company's yard will be continued in operation as a ship repair plant under the direction of the Fore River branch of the Bethlehem Corporation.

Bids Taken for Reconditioning of Steamer Valdura

PROPOSALS for the repair of the steamship *Valdura,* which sustained damage as a result of going aground in the Hawaiian Islands, were opened at noon on November 22, at the office of Macfarlane, Garmey & Company, 32 Broadway, New York City. Robins Dry Dock & Repair Company, with a price of $65,650 and 30 days' time, submitted the lowest figure. The bids, which have been submitted to the owners for decision, were as follows:

		Days
Robins	$65,650	30
Tietjen & Lang	69,840	35
Bethlehem	71,700	33
Morse	82,000	35
Newport News	107,400	50
New York Harbor	117,421	60

Steamer Manitowoc Repair Work Goes to Alderton Shipyard

THE contract for repairs to the steamer *Manitowoc,* bids for which were received by the Foreign Transport & Mercantile Corporation, New York, has been awarded the Alderton Dry Docks Company, at a price of $3,797. The tenders were:

Alderton	$3,797
Morse	3,869
Staten Island	4,156
Tietjen & Lang	4,970
Robins	5,125
Fletcher	6,800

Transport Logan Goes to Bethlehem West Coast Yard

THE Bethlehem Shipbuilding Company, of San Francisco, Cal., was low bidder for reconditioning the United States army transport *Logan.* The work called for extensive alterations on the vessel's passenger accommodations and life-saving equipment. Tenders were as follows:

Bethlehem Shipbuilding Co.	$16,989
Moore Shipbuilding Co.	24,527
De Young Company	25,985
Hanlon S. B. & D. D. Co.	28,750

Midland Barge Co. is Lowest Bidder for Derrick Hull

THE Midland Barge Company, of Midland, Pa., with a price of $13,800, was low bidder for the construction of one steel derrick boat hull at the opening of bids by the United States Engineer Office, Pittsburgh, Pa., on November 20. The boat is to have a molded length of 80 feet, molded beam 34 feet and molded depth 5 feet. The bids were as follows:

Midland Barge Co.	$13,800
Independent Bridge Co.	14,300
Pennsylvania Bridge Co.	14,600
Dravo Contracting Co.	16,450
Charles Ward Engineering Works.	16,500
American Bridge Co.	17,000

Shipping Board Graduates Its First Classes in Study of Fuel Oil Burning and Development

Class No. 1, Shipping Board Fuel Oil School.
Top row, left to right: Messrs. Henning, Healey, Phelan, Clavin, Smith, Shoe.
Second row: Messrs. Klein, Jefferson, Stevens, Norton, Grace, Cunningham.
Front row: Messrs. Hobbs, Sullivan, Peterson, Brierly, Brierly.

THE first class in the Shipping Board's Fuel Oil School, which has been established at the Philadelphia Navy Yard under the general direction of the Navy and Fuel Conservation Committee of the Shipping Board, has completed its course of instruction. All the members of this class were exceedingly enthusiastic over the prospects of success for the school. The Fuel Conservation Committee hopes to further the science of oil burning in the American merchant marine and in that way to contribute to the greater efficiency of our vessels.

As an indication of the interest inspired by this course, the assistant port engineer of one of the large steamship companies states that information given out at the school was immediately put to practical use on one of his steamers.

"I took the opportunity on October 28," he said, "of giving the chief and the first and second assistant engineers a full two hours' instruction covering several important points that were brought out in the course, taking these men inside of one of the boiler furnaces and explaining in detail important points with regard to burner adjustments, refractories, etc.

"You may recall on the steamship *Satartia* (fitted with three B. & W. boilers) that we had the crew rebuild six side walls complete on her last voyage to India, placing the necessary material on board prior to sailing. This work, as you know, was very well done and made a considerable saving in repair bills."

A second class of instruction began on November 7 and was made up of thirteen engineers including representatives from the Munson Line, Moore & McCormack, United States Lines, J. H. Winchester & Company, Kerr Steamship Company and the Mallory Transport Company. The third class began November 20.

Susquehanna Job Goes to Atlantic Basin Iron Works

THE steamship *Susquehanna* was awarded the Atlantic Basin Iron Works for repairs as a result of bids received by the Shipping Board, 45 Broadway, New York, on November 20. The prices submitted were:

Atlantic Basin	$15,290
Morse	18,680
Tietjen & Lang	21,119
New York Harbor	23,840

Shipping Board Offers Four Ships at Public Sale

THE Shipping Board is offering for sale four ships built by the Los Angeles Shipbuilding and Dry Dock Company, namely, the *West Greylock, West Faralon, West Chopeka* and *West Prospect,* of 10,000 deadweight tons each and ranked among the finest of the fleet. The board is holding them for more than $30 a ton each, according to Sidney Henry, director of sales.

BUSINESS NOTES

The committee on docks, piers and wharves, of the National Fire Protection Association, will hold a meeting on Tuesday, December 13, at 9:30 A. M., in the room of the National Board of Fire Underwriters, 67 William Street, New York City. It is expected that this meeting will be the most important meeting of the committee up to this time. Charles H. Fischer is chairman of the committee.

Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Reconditioning, Norfolk, Va.—The Lake Gallien went to Norfolk to be reconditioned.

Repairs to Steamer, Oakland, Cal.—Steamer La Placencia was placed on ways at Moore Shipyard, Oakland, for repairs.

Admiral Liner Drydocked, West Coast.—Admiral liner Spokane went to Todd Harbor Island plant to be cleaned and painted.

Steamer Repaired, Superior, Wis.—Steamer C. S. Robinson went to Superior to be repaired. Twenty-six plates were replaced.

Vessel Overhauled, San Francisco, Cal.—Pacific Mail Steamship President Cleveland went to Bethlehem plant for overhauling.

Contract Awarded, Hoboken, N. J.—W. & A. Fletcher Company awarded contract for repairs to steamship Fegundo. Price $7,000.

Miscellaneous Repairs, Chester, Pa.—Union Oil Company's tanker Puento went to Sun Shipyards to be drydocked for miscellaneous repairs.

Damaged Steamer Drydocked, Galveston, Tex.—Steamship Saccarappa went to Galveston for repairs to damages sustained in foreign waters.

Shipbuilding, Whitehaven, Md.—The Whitehaven Shipbuilding Company is rebuilding three large schooners and is overhauling seven others.

Cleaning and Painting, San Francisco, Cal.—The Rose Mahony went on Bethlehem Shipbuilding Company's drydock for cleaning and painting.

Steamship Reconditioned, Philadelphia, Pa.—Steamship Tippah, of the Inland Steamship Company, went to a local yard for reconditioning.

Steamer Drydocked, Providence, R. I.—New Bedford steamer Ucatena was hauled out on the East Providence drydock for scraping and painting bottom.

Plates Repaired, Seattle, Wash.—Freighter Ketchikan went to the Todd plant to have plates repaired. Several punctured plates will be replaced.

Tanker Repairs, Chester, Pa.—Tanker Chester Sun, owned by the Sun Oil Company, was drydocked at the Sun shipyard at Chester for repairs.

Contract Awarded, Hoboken, N. J.—W. & A. Fletcher Company was awarded the contract of reconditioning the steamer Eastern Trader. Price $81,000.

Bow Replacement, San Francisco, Cal.—Steamer Sudbury went to Bethlehem Shipbuilding Company, San Francisco, to have several of its bow plates replaced.

Tanker Inspected, San Francisco, Cal.—Shipping Board tanker Hamer went on drydock for inspection prior to being taken over by the General Petroleum Company.

General Repairs to Steamer, New Orleans, La.—New York and Porto Rican Steamship Company's steamship Carib went to Johnson Iron Works for general repairs.

Repairs, San Francisco, Cal.—Mexican steamer Colima and motorship Cycol went to the Barnes & Tibbitts' yards to undergo general overhauling and minor repairs.

Lengthening of Vessel, New Orleans, La.—Ferryboat Ruth went to Johnson Iron Works to be lengthened fifteen feet and to have her guards widened three feet.

Two Steamers to be Reconditioned.—After their next round voyages, the Resolute and Reliance, of the United American Lines, will be withdrawn from service and drydocked to be conditioned for their winter cruises.

Overhauling of Steamer, New Orleans, La.—Johnson Iron Works awarded contract to install Falk gears and overhaul machinery of steamship West Wauna. Price $24,400.

West Coast Activities.—The Bethlehem Shipbuilding Corporation, San Francisco, was awarded the following: Harbor Tug James N. Gilette, steamer Ebian and steamer Mahoe.

Annual Inspection, Seattle, Wash.—Steamship Starr, operating in mail service from Seward, Alaska, westward, will go to Seattle for annual repairs, inspection and overhauling.

Repairs to Barge, Staten Island.—The New York Harbor Dry Dock Company was awarded the contract for repairs to the East Jersey Railroad Company's barge No. 26. Price $6,013.

Oil Barge Launched, New Orleans, La.—Johnson Iron Works recently launched a 5,100-barrel capacity oil barge to be used by the Southern Paper Mills. It is 144 feet long and is of steel.

Ferryboat Launched, San Francisco, Cal.—Steel ferry steamer Shasta was launched at the Union plant of the Bethlehem Shipbuilding Corporation for the account of James Rolph & Company.

New Shaft on Tug, New Orleans, La.—Johnson Iron Works awarded contract to furnish and install new shaft on stern wheel river tug of Mississippi Warrior Service. Approximate price, $4,000.

Repairs to Steamers, Staten Island, N. Y.—New York Harbor Dry Dock Company, Staten Island, was awarded repairs to steamships Nile and Sarcoxie. Prices $4,553 and $1,135, respectively.

Liner to Undergo Reconditioning.—At the conclusion of its next round voyage the George Washington, of the United States Lines, will be withdrawn from service for a month to be reconditioned.

Tug Drydocked, Savannah, Ga.—Tug W. B. Keene, Savannah-New York Transportation Company, went on ways of the Wilkinson Marine Railway & Drydock Company to have new propeller and shaft fitted.

Contract Awarded, San Francisco, Cal.—The Bethlehem Shipbuilding Corporation was awarded the contract to replate the bow of the freighter Walter Luckenbach, damaged in a collision. Price $20,934 and 16 days.

Isonomia Contract, Baltimore, Md.—The latest addition to the Foster Fleet, is the Pacific Freighters Company steamship Isonomia, recently fitted with Foster Waste Heat Type Superheaters, at Baltimore, Md.

Contract Awarded, Hoboken, N. J.—The contract for the conversion of 17 tugs and 5 lighters, of the New York Central Railroad Company, was awarded to Tietjen & Lang plant of the Todd Shipyards Corporation. Approximate expenditure, $250,000.

Conversion to Oil Burner, Newport News, Va.—The Newport News Iron Works, Inc., of Newport News, Va., is completing the contract awarded to them by the E. K. Wood Company, of San Francisco, of converting the Lake Bridge from coal to oil burner.

Possible Reconditioning.—It is reported in marine circles that the steamship Plainfield, of 4,112 deadweight tons, has been sold by the Shipping Board to the Baltimore and Carolina Steamship Company and that there is a strong possibility of the new owners reconditioning the ship.

Westinghouse Reduction Gears, Pittsburgh, Pa.—The Compagnie Generale Transatlantique (French Line), Paris, has ordered from the Westinghouse Electric & Manufacturing Company, East Pittsburgh, six sets of double reduction, floating frame type gears of 6,000 horsepower each.

Award of Contract, Savannah, Ga.—Wilkinson Marine Railway and Drydock Company was awarded the contract of work on Martin's Industry Light Vessel No. 1. Specification called for exterior work on the hull, including scraping and painting below the water line, and refinishing the hull.

Extensive Reconditioning, San Pedro, Cal.—The Lake type Shipping Board freighter Cowiche, purchased on the East Coast several months ago by the California and Oregon Lumber Company, went to the plant of the Los Angeles Shipbuilding and Dry Dock Corporation to undergo extensive reconditioning.

Contracts Awarded, New Orleans, La.—The following were awarded to the Jahncke Dry Dock Company: Tanker Anomia, to be refitted and have stern post straightened; steamship West Jaffrey, minor repairs; steamer Nacata, to undergo extensive repairs; Shipping Board steamship Lafcomo, repairs.

Bethlehem Yard Activities, San Francisco, Cal.—The Bethlehem Shipbuilding Company was awarded the following repair jobs, including cleaning and painting: Steamers Lurline, Carlos and C. A. Smith, barkentine Echo, schooner Alumna, steam schooner Katherine, motorship Oronite and barge Erskine M. Phelps.

Bunkering Ship, New Orleans, La.—Consolidated Fuel Company, New Orleans, awarded contract to Johnson Iron Works for construction of steel collier hull, 110 feet by 35 feet by 6 feet 6 inches, for delivery in 1923; boilers and conveyer machinery to be furnished by owner. Contract price for hull and tower, $25,300.

Contract Awarded, Camden, N. J.—The contract for the construction of a new passenger and freight ship for the Red "D" Line was awarded to the New York Shipbuilding Corporation; ship to have overall length of 320 feet, driven by twin screws and equipped to carry about 50 first class and 25 second class passengers.

Extensive Repairs, Bremerton, Wash.—The steamship Empress of Australia was awarded to Todd Dry Docks Company, Seattle, for extensive reconditioning. The company deemed it advisable to do the work at the United States navy yard's graving dock instead of attempting to lift the big ship in the Seattle floating dock.

Miscellaneous Contracts, New Orleans, La.—Following contracts awarded Johnson Iron Works: work of installing new plates in turbine and minor repairs to turbine auxiliaries on steamship West Sequoia; and making of repairs on steamship El Demar, including shortening of masts and minor repairs to machinery and piping.

Construction of Two Ships, Kearny, N. J.—Federal Shipbuilding Company was awarded contract for construction of two Diesel propelled ships for United States Steel Products Company. Boats will be 262 feet over all, length 250 feet keel, 43 feet beam and 20 feet deep, ships to be equipped with Diesel oil engines and electric hoists.

Steamers Change Ownership, Norfolk, Va.—A trade has been made between the Buxton Line and the Norfolk and Mobjack Bay Steamboat Company by which the former acquired the steamer Ocracoke, formerly owned by the Old Dominion Steamship Company, and the latter, the steamship Sieur De Monts, purchased recently by the Buxton Line from the army.

Contracts for Oil Burners, New York.—Standard Transportation Company, New York, installed in one of their tugs a complete installation of Peabody-Fisher wide range oil burners. The Western Union Cable Company placed a contract for the removal of oil burning system in the cable steamer Lord Kelvin and installation of Peabody-Fisher wide range burners.

Vessel Repairs, Staten Island, N. Y.—The following vessels were awarded to the New York Harbor Dry Dock Company for repairs: Westport, of the Shipping Board; Cosmos, Ellerman Lines; subchaser Sloan Damenhauer; Sapanta, Standard

Transportation Company; oil barge No. 5, Tidewater Oil Company; West Gotomska, Shipping Board; Somerset, Standard Oil of New Jersey; Argen, Standard Oil of New York; Castle Lodge and Westerner, Shipping Board.

Steel Electric Cable Ship, New York.—Bids will be received until December 4 by J. W. Millard & Brother, naval architects, 17 State Street, New York City, for construction and outfitting and delivery of a steel twin screw, Diesel electric, cable laying vessel for the Western Union Telegraph Company; length from fore side of stern to after side of stern post on 16-foot waterline, 211 feet; breadth molded 34 feet; depth molded to upper deck, 18 feet 6 inches.

New Passenger and Freight Steamer, Seattle, Wash.—The Todd Shipyards Corporation was awarded a contract to build a twin screw combination passenger and freight steamer for the Alaska Steamship Company. The vessel will have a length of 350 feet between perpendiculars, 47 feet 6 inches beam, draft of 20 feet, speed about 16 knots, cargo capacity 2,500 tons, accommodations for 235 passengers and will burn oil fuel with Todd mechanical burners.

GOVERNMENT WORK

Dredging, Norfolk, Va.—U. S. Engineer plans dredging in Appomatox River.

Dredging, New York, N. Y.—U. S. Engineer, 2nd District, plans dredging in Raritan River.

Steel Hull, Huntington, W. Va.—U. S. Engineer plans to purchase steel hull for quarter-boat.

Maneuver Boat, Huntington, West Virginia.—U. S. Engineer plans to purchase maneuver boat for Dam 30.

Dredging, Puget Sound.—Specification 4708.—Bureau of Yards & Docks, Navy Department, Washington, D. C., rejected bids for dredging Puget Sound.

Piers, Pearl Harbor.—Specification 4687.—Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon receive bids for two 335-foot reinforced- concrete piers, 18 feet wide, including dredging and filling.

SHIPYARDS AND DRY DOCKS

Dry Dock Plant Purchased, Boston, Mass.—The Bethlehem Shipbuilding Corporation has purchased the plant of the Simpson's Patent Dry Dock Company, whose main office is located at 23 Ames Building, Boston, Mass. The yard is on Marginal street, East Boston. It was established in 1856.

Three graving docks have been maintained, one 465 feet long, one 250 feet long and one 150 feet long. The company's officers were: Charles F. Crowell, president; Ezra H. Baker, vice-president, and Arthur M. Baker, general manager. The yard will be operated as a ship repair plant under the direction of the Fore River branch of the Bethlehem Corporation.

Firms Consolidate, Boston, Mass.—The engine and ship repair business and good will of the Bertelsen & Petersen Company, of East Boston, has been purchased by the Atlantic Works of East Boston. Jens Bertelsen is to become vice-president of the Atlantic Works, and Paul Bertelsen will be works manager, both becoming stockholders and directors by the new arrangement. Such machinery as can be used to advantage in the Atlantic Works will be removed and the balance of the Bertelsen & Petersen plant will be closed out. The Atlantic Works will put in a large floating drydock of some 10,000 tons capacity. The company already has three marine railways.

PORT IMPROVEMENTS

Pier, Montreal, Que.—Sterling Construction Company, Montreal, Canada, was awarded a contract by Montreal Harbor Commissioners for 300-foot extension to Jacques Cartier Pier. Price $150,000.

Wharf, Montreal, Que.—Harbor Commissioners awarded a contract to Barrett-McQueen, Ltd., 373 Canada Cement Building, to build 500 foot concrete extension to Imperial Oil Wharf, Longue Pointe. Price $200,000.

Contract Placed, Norfolk, Va.—Another unit was added to the Norfolk municipal terminal development project when the City Council, by a unanimous vote, recently authorized the awarding of a contract to the Raymond Concrete Pile Company for construction of a 1,200 foot pier, 494 feet wide, at a new municipal grain elevator. The cost will be $680,000.

Although the bond issue of $5,000,000 voted by the city at a special election in February included not only a grain elevator, but also separate additional projects—marginal wharves, a pier and warehouses—it was decided to hold up the latter two of these three developments temporarily, because of the likelihood that the city would obtain a long-term lease on the Army Base warehouses and piers. So a contract was awarded A. M. Crain & Company for construction of the elevator, at a cost of $639,-000 and a later contract was entered into with the Raymond Concrete Pile Company for construction of the marginal wharves and jetties.

Grain Elevator, Baltimore, Md.—The Pennsylvania Railroad completed and had in full operation by November 15 the $5,500,000 grain elevator it had had under construction for some months. This addition to the company's waterfront facilities of Baltimore, Md., increases its grain handling capacity to 4,250,000 bushels. The enlargement has a capacity of 1,300,000 bushels of grain in bins, the structure being of iron and concrete fireproof construction, driven throughout by electric power. Its location is on deep water where ships to 35-foot draft can enter, four ships to be loaded at one time. The hourly capacity for loading vessels is 120,000 bushels, a part of the equipment being four mechanical unloading machines which release automatically the grain door of the box cars loaded with grain. These unloading machines have an hourly capacity of 40 cars or 80,000 bushels of grain.

NEW INCORPORATIONS

Fidello Navigation Corporation, $50,000, chartered in Delaware.

Winton Navigation Corporation, $50,000, chartered in Delaware.

Hunter Navigation Corporation, $50,000, chartered in Delaware.

Charles R. McCormick Steamship Company, capital $1,500,000 incorporated at Sacramento, Cal.

The Philadelphia and Norfolk Steamship Company, capital $1,500,000, chartered under Delaware laws.

The International Steamship Company, of New York, capital $100,000, chartered under Delaware laws.

Maritime Trust Company, capital $1,000,000, divided into 1,000 shares of $100 par value and a paid-in surplus of $1,000,000; New York.

Trans-American Trading Company, of Manhattan, capital $50,000, chartered at Albany. Incorporators: R. M. Gardner, O. G. A. Hogstedt and E. T. Nappin.

Kismet Navigation Corporation, of New York, capital $50,000, chartered under Delaware laws. Incorporators: William R. Greenway, Maurice V. Geneh and W. V. Sullivan, of New York.

Coastal Steamship Corporation, of Manhattan, capital $150,000, incorporated at Albany. Incorporators: J. W. Cunningham, C. E. Goodhue and C. H. Hunter. Lampke & Stern, attorneys, 29 Broadway, New York.

F. L. Zimmerman & Company, Ltd., of Manhattan, capital $50,000, chartered at Albany, to do a ship chartering business. Incorporators: F. L. and T. E. Zimmerman and L. F. Schworm. Lampke & Steinof, 29 Broadway, attorneys.

The Delanco Construction Company, of Delanco, N. J., capital $100,000, chartered at Trenton, to do a shipbuilding business. Incorporators: Louis D. Steele, Jacob P. Schmidt, of Delanco; Ridgway Spotts, of Edgewater Park, and Norman J. Calhoun, of Camden.

The Great Northern Steamship Company, capital $500,000, of which 9,000 shares are preferred 9 per cent cumulative stock and 10,000 shares are common stock of the par value of $50, incorporated under laws of Massachusetts as a transatlantic steamship company. Incorporators: Robert E. Tucker, Ernest W. Tucker and Perley A. Hale, all of Troy, N. H.; Norman D. Tucker and Earl E. Howard, of Fitchburg, Mass.; Fred O. Howard and Edna Howard, of Boston, and Florence S. Howard, of Gardner, Mass.

FOREIGN ACTIVITIES

Port Construction, Spain.—A company has been formed in Lisbon for the purpose of constructing a port on the Peninsula on Montijo, on the opposite side of the River Tagus, to Lisbon.

Order Placed, Scotland.—Messrs. Alexander Stephen & Son, Linthouse, have secured an order for the construction of a new steamer for the Clyde Shipping Company, Glasgow. The new ship will be 250 feet long, of 1,560 tons gross and the propelling machinery will be triple expansion engines.

Clyde Shipbuilding Output, Scotland.—In October the Clyde shipyards launched half a dozen vessels of 53,670 tons—the third largest monthly total for the year. The record for the ten months consists of 107 vessels of 342,888 tons, which is less than that of the corresponding period of last year by 88 vessels of 63,107 tons, and than the highest figures on record—those of 1913—by 111 vessels of 216,946 tons.

New Liner, New Zealand.—Union Steamship Company of New Zealand is planning the immediate construction of a 600-foot Diesel liner to be operated under the British flag between British Columbia and the Antipodes. She will be the largest vessel in the Pacific Coast-Australian trade and the first Diesel passenger carrier on the Pacific. Negotiations for building the vessel are being made with a Glasgow shipbuilder.

Tanker Launched, France.—A motor-driven tanker built for the Societe Generale des Huiles de Petrole was recently launched at Mantigues (Bouches du Rhone). The vessel, intended for carriage of petrol and mazout between Marseilles and Mediterranean ports, is fitted with six tanks having a total capacity of about 600 tons. Propelling machinery consists of a semi-Diesel motor of 200 horsepower, giving a speed of 6½ knots fully loaded.

New Vessel, England.—Representatives of the Cunard Line in New York received word of the successful launching of the latest addition to the company's fleet, the Franconia. The ship, replacing one of the same name, possesses many new features for comfort and convenience of passengers. She is 620 feet long, 74 feet in breadth and 45 feet deep, and she has a gross tonnage of 20,000, average sea speed 16 knots. The vessel accommodates 330 first, 420 second and 1,000 third class passengers.

Successful Trials, Germany.—The Tonganjika, new Hamburg-American Line steamer, built by Messrs. Blohm & Voss, Hamburg, has completed successful trials. The ship, which has been built for the West African trade, left Hamburg on October 15 for her maiden voyage. She is 448 feet in length, 58 feet in breadth by 26 feet in depth and has a gross hold capacity of 8,537 tons. Accommodation is provided for 100 first class passengers, 80 second class and 100 steerage. The propelling machinery consists of four steam turbines, developing 3,700 indicated horsepower and giving a speed of 12 knots.

Ore Carrier Launched, Sweden.—The motor ore-carrier Luossa was recently launched from the yard of Gotaverken, Gothenburg, and is one of a number of such vessels which are under construction for the Grangesberg-Oxelosund Company. She is 385 feet in length, with a beam of 53 feet 5 inches and a molded depth of 34 feet and the deadweight capacity is 8,200 tons on 25 feet draught. The propelling machinery consists of two Burmeister and Wain type six-cylinder Diesel engines, each of 1,300 indicated horsepower. On the day she was launched a sister-ship, the Lulea, also built by Gotaverken, ran her trials.

Trial Trip, Montrose, Scotland.—The single screw cargo steamer S. S. No. 93, built by the London & Montrose Shipbuilding & Repairing Company, Ltd., for Messrs. Llewellyn, Merrett & Price, Ltd., of Cardiff, ran her official trials successfully; the speed obtained being a knot and a half in excess of the contract. She is of the raised quarter deck type with engines placed aft and is designed to carry 1,050 tons of cargo. The vessel was constructed for the owners' special trade.

Norris R. Sibley Goes to London Steam Turbine Co.

NORRIS R. SIBLEY, who has been in charge of the Westinghouse Electric & Manufacturing Company's marine department in New York for several years, has resigned to become New York district manager for the London Steam Turbine Company of Troy, N. Y.

Mr. Sibley has served as assistant and chief engineer in several of the lines of the

Norris R. Sibley

merchant marine, including the American Line (International Merchant Marine Company), Clyde Line, Mallory Line, Southern Pacific Company (Morgan Line), Panama Line (Panama Railroad), Lukenback Line, Benvenue Granite Company, and Metropolitan Dredging Company. For a time he covered the marine field for the *New York World*, the *New York Herald*, and the *Sun* Press Bureau and assisted in compiling "The Blue Book of Facts," a book on marine engineering.

After leaving the United States Army Transport Service in 1918, Mr. Sibley became connected with the Westinghouse Electric & Manufacturing Company. He served as guarantee engineer on the steamship *Westwood*, and the steamship *Agawam*, the first fabricated ship in the world. He was also the Westinghouse representative at the plant of the Submarine Boat Corporation, where he supervised the installation of propelling equipment on vessels built at those yards.

He is an alumnus of the Massachusetts Nautical School, a member of the National Marine League, and various marine engineering associations. Mr. Sibley's long experience in the steam turbine field well qualifies him for his new work. His office will be in New York City.

TRADE PUBLICATIONS

Concentration Salinity Indicators.—The elimination of salt from boiler feed water, particularly in the case of the modern watertube boiler with its high steaming capacity, led to the development of an electrical device by Leeds & Northrup Company, Philadelphia, Pa., in co-operation with the Babcock & Wilcox Company, New York, for determining the degree of salinity in boiler feed water. This instrument is also used for the accurate measurement of the salinity of condensates, distillates, evaporator brine and the like. Complete details are given in a booklet which was distributed at the Marine Exposition.

Monel Metal in Service at Sea.—For a number of years before the recent war the United States Navy had been developing applications of Monel metal and had in many instances substituted it for other metals previously thought best under destructive forces. A few of the larger marine equipment manufacturers worked along similar lines. It has gradually been adopted to use in an almost endless variety of marine applications. A description of the metal and its many uses aboard ship are described in a pamphlet issued by the International Nickel Company, New York.

The Manufacture of Condenser Tubes.—In a booklet issued by the Chase Metal Works, Waterbury, Conn., complete details of the manufacture of condenser tubes are given, starting with a general outline of the three processes of producing tubes; the piercing process, the cupping process and the cast shell method. The properties and specifications and the causes of condenser tube failures are given, as well as the results of the study of factors controlling grain size of Admiralty tubes. The remainder of the booklet includes details of the physical requirements of the tubes, the method of test and inspection, as well as the use and care of condenser tubes in service.

Foster Waste Heat Type Superheaters.—Superheaters of the waste type for marine boilers have been installed in the ships of all nations. Details of such installations with complete descriptions of the superheaters are given in a bulletin issued by the Power Specialty Company, of New York. Thermometers and soot blowing apparatus with suitable safety valves for the superheaters are included. Operating records of superheaters on various ships and a list of ships equipped with Foster superheaters with their principal machinery details are also stated. Concluding sections give tabulated data on the properties of steam, fuel oil, steam pipe capacities and the like.

Duraloy.—Bulletin No. 221, of the Cutler Steel Company, Pittsburgh, Pa., contains a general description of the metal Duraloy, which has properties of resistance to oxidation, corrosion and abrasion. Duraloy is a chromium iron alloy developed as a low cost alloy to resist oxidation. It can be supplied in castings, bars, sheets and in rolled form responds to heat treatment in a manner similar to alloy steels. The pamphlet outlines the machining qualities, welding qualities and the resistance of this metal to heat, corrosion and the like.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander S. M. Robinson, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City.
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

The New York Tow Boat Exchange
11 Moore St., New York.
Secretary—Irving G. Keller.

Port of New York Authority
11 Broadway, New York.
Chairman—E. H. Outerbridge.
Secretary—William Leary.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
President—H. H. Raymond.
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

EXETER ROTARY PUMPS

FEUERHEERD PATENTS

"A ROTARY pump combining the advantages of the centrifugal and reciprocating types. Two rotors of simple and rugged construction, each supported on its own bearing, properly lubricated and remote from the liquid being pumped.

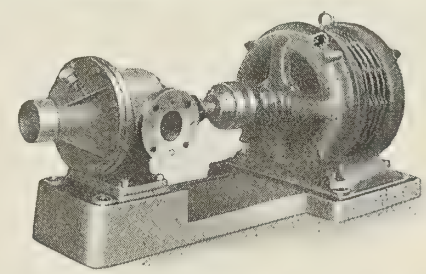
Rolling action between rotors minimizing wear, decreasing replacement and maintenance cost.

Straight line flow of liquid resulting in high efficiencies.

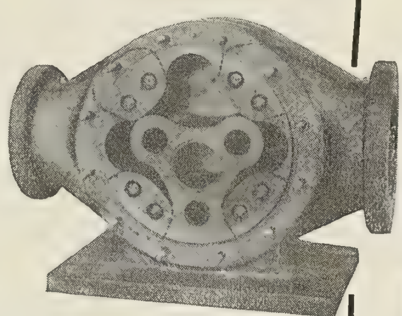
No eccentric action.

The Exeter pump is self-priming, direct, acting with uniform flow. It can be arranged to operate with any form of drive,—electric motor, vertical steam engine, turbine, gas or oil engine. In capacities up to 200 GPM it operates at speeds to allow for direct connection to motors, eliminating gears and resulting in compact silent running unit.

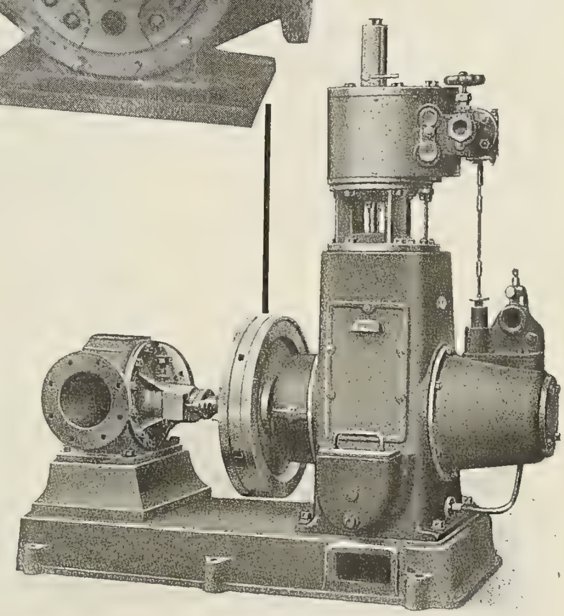
It is particularly adapted for marine use for the following services: Cargo pump on tankers, ballast, fire and bilge, fuel oil transfer, oil supply to burners, lubricating oil, fresh water and sanitary. Manufactured either in cast iron, all bronze, or bronze fitted."



200 G.P.M. All Bronze Pump Direct Connected to Motor, Eliminating Gears



Directly Connected Motor Driven Exeter



Directly Connected Steam Driven Exeter

Exeter Machine Works, Inc.

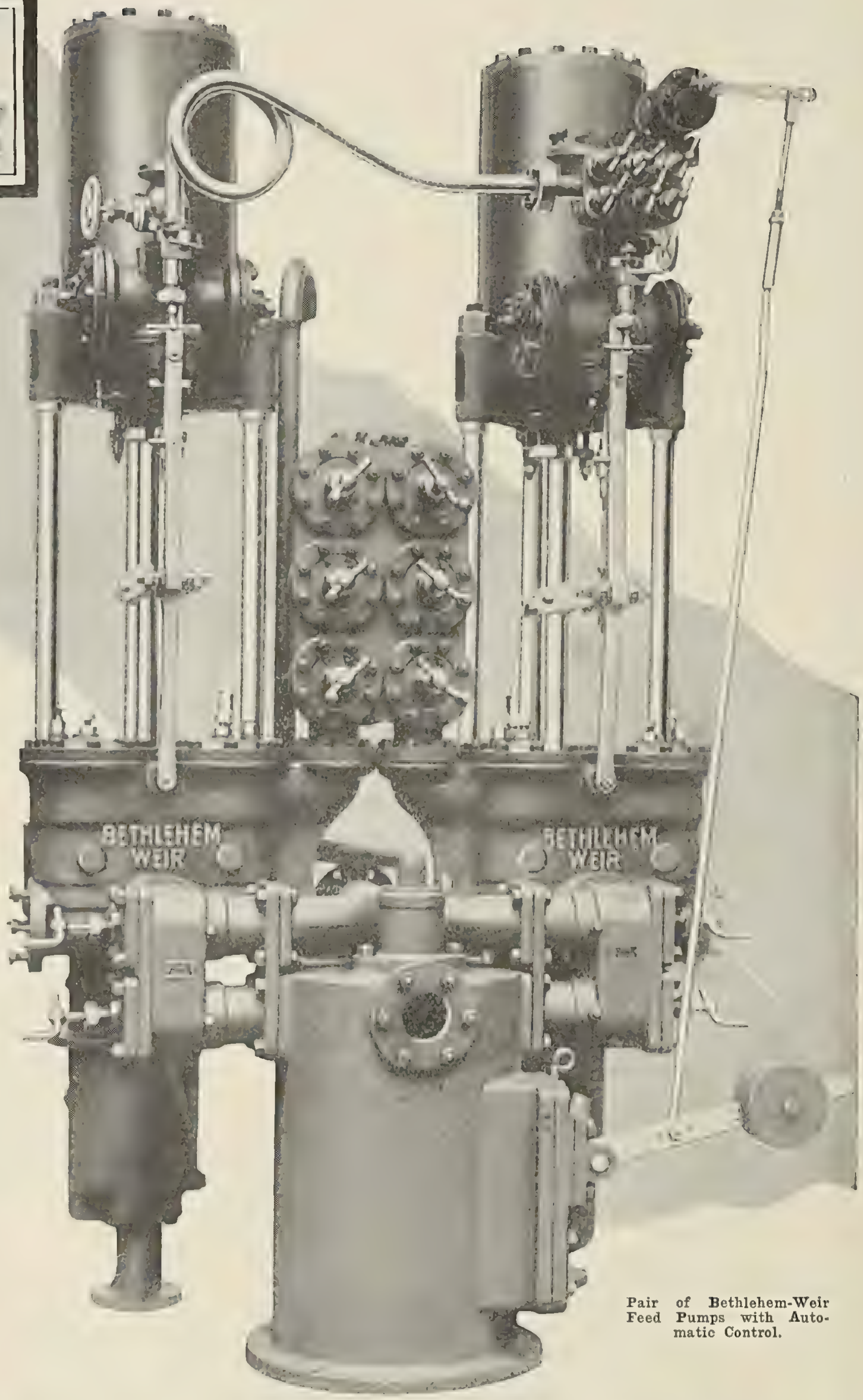
Works & General Offices
West Pittston, Pennsylvania

hila. Off. Widener Bldg. ***Chicago—Peoples Gas Bldg.***

New York - Office 30 Church St.

A Feed Pump

S. S. G. Harrison Smith 20,500-Ton Combination Ore and Oil Carrier. Equipped with Bethlehem - Weir Feed Pumps.



Pair of Bethlehem-Weir Feed Pumps with Automatic Control.

A Few of the Other Bethlehem-Weir Products

—each embodying the results of an unexcelled experience in handling marine auxiliary problems.

—each matching the Bethlehem-Weir Feed Pump for serviceability and reliability.

Bethlehem-Weir Turbo-Feed Pumps

Bethlehem-Weir Fuel Oil Pumps

Bethlehem-Weir "Dual" and "Monotype" Air Pumps

Bethlehem-Weir Uniflux Condensers

Bethlehem-Weir Evaporators and Distillers

BETHLEHEM

Announcing the New Product

THE TROUT

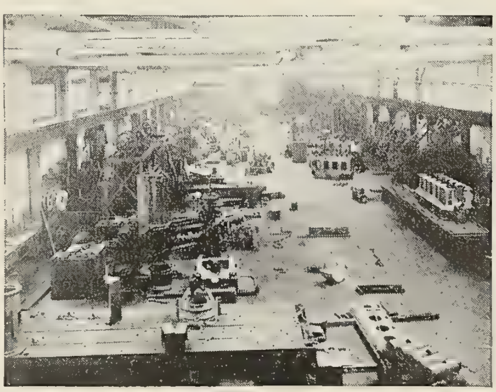
(Leissner System

TROUT
BUFFALO U.S.A.

The Plant behind the TROUT DIESEL—Established 1848.

THE VALUE OF AGE

in an Engineering works lies, not alone in the wealth of experience available in its records, but also in the spirit of its men. Most of our officials and mechanics learned their trades here. Many of them represent the second or third generation of employees. These satisfied and loyal men take pride in upholding our traditions of quality and practical design.



View of Our Main Machine Shop

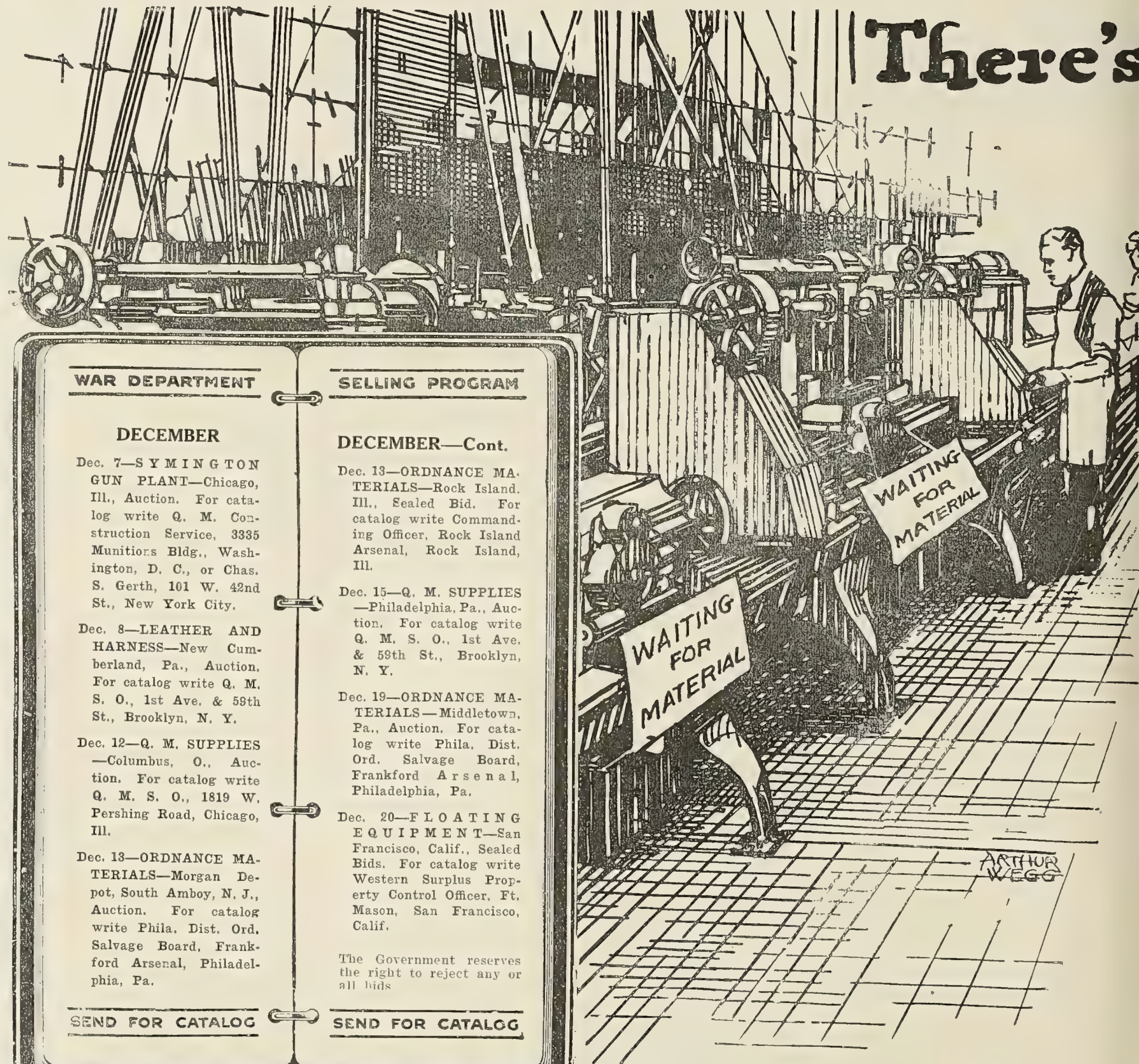
"You receive these benefits when you deal with us."

Write for further particulars to—

THE H. G. TROUT CO.

224-50 Ohio Street,
Buffalo, N. Y.

There's



WAR DEPARTMENT SELLING PROGRAM

DECEMBER

Dec. 7—SYMINGTON GUN PLANT—Chicago, Ill., Auction. For catalog write Q. M. Construction Service, 3335 Munitions Bldg., Washington, D. C., or Chas. S. Gerth, 101 W. 42nd St., New York City.

Dec. 8—LEATHER AND HARNESS—New Cumberland, Pa., Auction. For catalog write Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

Dec. 12—Q. M. SUPPLIES—Columbus, O., Auction. For catalog write Q. M. S. O., 1819 W. Pershing Road, Chicago, Ill.

Dec. 13—ORDNANCE MATERIALS—Morgan Depot, South Amboy, N. J., Auction. For catalog write Phila. Dist. Ord. Salvage Board, Frankford Arsenal, Philadelphia, Pa.

DECEMBER—Cont.

Dec. 13—ORDNANCE MATERIALS—Rock Island. Ill., Sealed Bid. For catalog write Commanding Officer, Rock Island Arsenal, Rock Island, Ill.

Dec. 15—Q. M. SUPPLIES—Philadelphia, Pa., Auction. For catalog write Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

Dec. 19—ORDNANCE MATERIALS—Middletown, Pa., Auction. For catalog write Phila. Dist. Ord. Salvage Board, Frankford Arsenal, Philadelphia, Pa.

Dec. 20—FLOATING EQUIPMENT—San Francisco, Calif., Sealed Bids. For catalog write Western Surplus Property Control Officer, Ft. Mason, San Francisco, Calif.

The Government reserves the right to reject any or all bids

SEND FOR CATALOG SEND FOR CATALOG

WAR DEP

10 G.A.

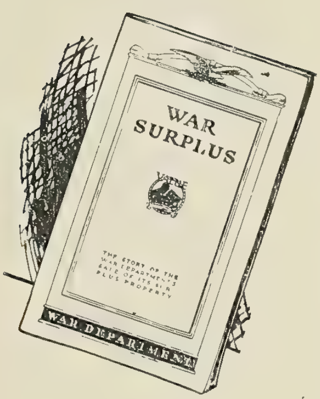
No Profit in Marking Time

IDLE machines do more than gather dust. They pile up a costly overhead—while you're waiting for the material that wasn't delivered on schedule.

Many a plant has been saved this embarrassment and expense by discovering a War Department Sale on just the materials they needed. For every War Department Sale means *immediate delivery!*

And a big saving, as well.

Look in your business paper or the daily press for the Sales announcements. When you find one that fits your needs, send for the catalog. Then seize your opportunity, for such a one will never come again. Address inquiries to Major J. L. Frink, Chief, Sales Promotion Section, Office, Director of Sales, Room 2515, Munitions Building, Washington, D. C.



Send for this booklet, The Story of War Department Sales

ARTMENT

Who wants these boats?

MARINE EQUIPMENT

Floating Equipment located in the Philippines and Alaska is offered for sale by sealed bid on December 20th

THERE are 22 boats in all, consisting of Gasoline and Steam Launches, a Yacht, Transport, Barge, two Yawls, two Sub-Chasers and two Distribution Barks. Seven of these boats are in poor condition, but the remainder are in fair or serviceable condition. This equipment is located and designated as follows:

Manila, P. I.—Steam Launch, "Chicago," length 85′, wood; Steam Launch, "New Orleans," length 86′, wood; Steam Launch, "Peterson," length 57′ 4″, wood; Gasoline Launch, "Hugh McGrath," length 35′, wood; Steam Yacht, "El Aquila," 185′, steel; Steam Launch, "Louisville," length 72′, wood; Steam Launch, "Reilly," length 78′, wood; Army Transport, "Warren," length 370′ 7″, steel; Steam Launch, "Bangor," length 84′, wood; Steam Launch, Florida, length 71′ 6″, wood; Steam Launch, "Missoula," length 86′, wood; Steam Launch, "Rochester," length 69′, wood; Sub-Chaser, V-11, length 110′, wood.

Honolulu, H. T.—Gasoline Mine Yawls, M-220 and M-221, length 24′, wood; Sub-Chaser, V-10, length 110′, wood; Distribution Boats, L-5 and L-6, gasoline motors, length 32′, wood.

Valdez, Alaska—Harbor Boat, "Lieut. C. V. Donaldson," length 62′, wood, equipped with 1 Marine fore and aft compound engine; Barge, capacity 30 tons, wood.

Fort Gibbons, Alaska—Gasoline Launch, "Walter H. Rodney," length 20′, wood.

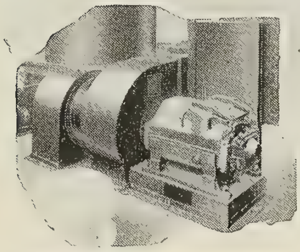
Fort St. Michael, Alaska—Wood Lighter, length 45′, wood.

Circular proposal gives complete specifications and all terms of sale. Same can be obtained at either of the addresses below, where bids will also be opened. The Government reserves the right to reject any or all bids.

Western Surplus Property Control Officer, Fort Mason, Cal.
Commanding Officer, Q. M. Intermediate Depot, Seattle, Wash.
Commanding Officer, Philippine Q. M. Area Depot, Manila, P. I.
Commanding Officer, Honolulu Q. M. Area Depot, Honolulu, H. T.
Assistant Surplus Property Officer, where boats are located.

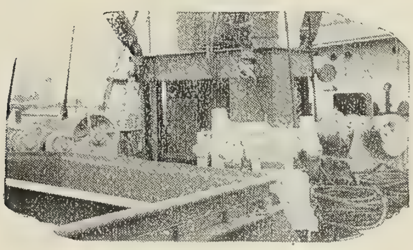
WAR DEPARTMENT

Where "Electric" means Economy



G-E Motor Driving Ventilating Fan on Deck, S. S. Munargo

Anchor Windlass, G-E Motor-driven, M. S. Kennecott



G-E Motors Driving Cargo Winches

G-E MARINE EQUIPMENT TO MEET YOUR REQUIREMENTS:

- Electric Drive for Motorships
- Turbine-electric Drive
- Marine Geared Turbines
- Electric Drive for Auxiliaries

Don't Pipe Steam to the Ship's Roof

Imagine a factory with steam-driven machinery on the roof, steam pipes exposed and uncovered, engine room apparatus installed in a small space and inaccessible, and pipes, valves, and fittings adding steam losses by leaks and radiation. Such a plant would resemble a ship with steam-driven auxiliaries.

It has been proved that electricity is transmitted and applied more economically and with greater reliability than any other form of power. And today there is electrical apparatus built for service on the sea.

The General Electric Company can supply auxiliary marine power plant equipment, enclosed ventilated motors and special control for below-deck auxiliaries, waterproof motors and control for use on deck, marine searchlights, and other auxiliaries. It's all designed for severe marine conditions.

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

26-50

Full speed through the storm

Returning from a voyage to Brazil in September, 1922, the U. S. S. Maryland ran at full speed through a severe gale, the wind reaching 75 miles an hour, and heavy seas pouring over her decks.

While full credit is given her new electric drive, this noteworthy performance would not have been possible if the power plant, including the Anaconda condenser tubes, had not been absolutely dependable.

Anaconda condenser tubes are dependable because of their physical soundness, correct composition and uniform microscopic structure. Embodying a superior quality which is the result of more than a century's technical and mechanical development, Anaconda condenser tubes are used in large quantities by the U. S. Navy and the foremost American ship operators.

Prices quoted upon application. Send inquiries to the nearest office.

THE AMERICAN BRASS COMPANY
GENERAL OFFICES, WATERBURY, CONN.

MILLS AND FACTORIES
Ansonia, Conn. Torrington, Conn. Waterbury, Conn. Buffalo, N.Y. Kenosha, Wis.

OFFICES AND AGENCIES
New York Philadelphia Boston Providence Pittsburgh
Cleveland Cincinnati Detroit Chicago St. Louis San Francisco

ANACONDA AMERICAN BRASS LIMITED, NEW TORONTO, ONTARIO, CANADA

ANACONDA
CONDENSER TUBES

Photo by Edwin Levick

America's Greatest Ship
—the Leviathan—
is Columbian Equipped

The stupendous task of repairing and equipping the mammoth *Leviathan* calls for the finest materials made. Hence, Columbian—the only rope containing the famous red, white and blue *Tape-Marker* Guarantee—has been selected by the Newport News Shipbuilding and Dry Dock Company for this important work.

Columbian *Tape-Marked* Pure Manila Rope is unequalled for durability, long service, and economical operation. That is *why* it is selected for use at the foremost dry docks, shipyards, and on board modern vessels where "first quality" is a pre-requisite.

The genuine Columbian can always be identified as "the Guaranteed Rope" by its red, white and blue *Tape-Marker* bearing the significant words "Guaranteed Rope, made by Columbian Rope Co., Auburn, N. Y." This marker is placed in one of the strands as a protection for both the buyer and manufacturer. Look for it when making your next purchase of rope.

Jobbers and Dealers:—It pays the mariner to use Columbian, and it pays *you* to sell it to him. Write today for catalogue and price list.

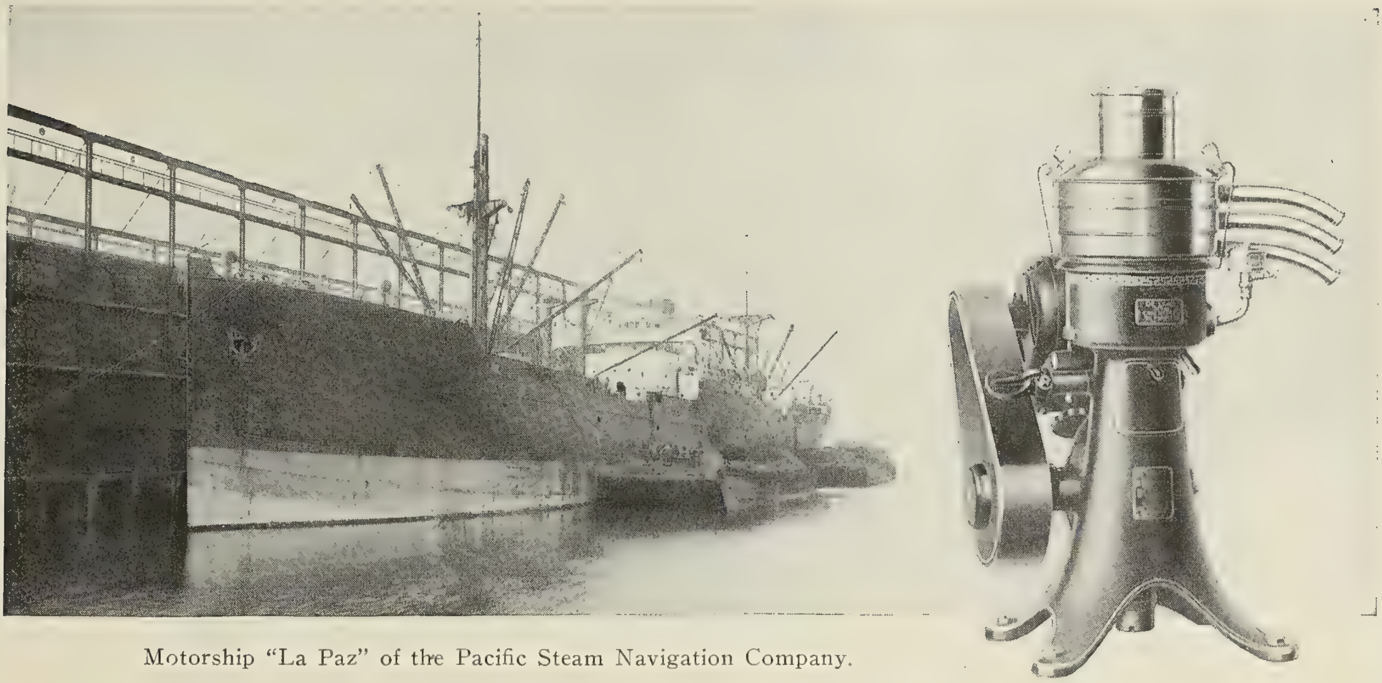
By Invitation Member
Emblem of BUSINESS CHARACTER
Rice Leaders of the World Association
Represents High Standing in NAME-PRODUCT-POLICY

Columbian Rope Company

372-90 Genesee Street

AUBURN, "*The Cordage City*" N. Y.

Branches— New York Chicago Boston Houston



Motorship "La Paz" of the Pacific Steam Navigation Company.

De Laval Oil Purifier is saving oil and protecting engines of motorship "La Paz"

The motorship fleet of the Pacific Steam Navigation Company was planned to transport cargo at the lowest possible cost per ton mile. Few, if any, items of design or equipment which contribute to a lower operating cost for the motorship were overlooked.

On each of these motorships, as on many others, a De Laval Oil Purifier has been installed. With this machine sludge is centrifuged out of the crank-case oil almost as fast as it is formed. As a result bearing wear is greatly reduced and the engines will, without a doubt, give more years of service with less expense for maintenance and overhauling.

By constantly removing impurities from lubricating oil, the De Laval Purifier also effects a great reduction in lubricating costs. The same oil is kept in the system indefinitely, the only replacement being that required to make up for losses by decomposition, evaporation and leakage. No oil need ever be taken out of the system.

No wonder that the Harland & Wolff Shipbuilding Company, builders of the "La Paz" and other vessels of the Pacific Steam Navigation Company's fleet, have in the past two years installed 47 De Laval Purifiers on various vessels building in their yards. The records of other British and American yards also show that De Lavals are now considered as necessary auxiliaries in the engine room of the Diesel or turbine-driven ship.

Mail the coupon for further information regarding ships of either class.

The De Laval Separator Company

New York, 165 Broadway **Chicago, 29 East Madison St.**

De Laval Steam Turbine Company
Trenton, N. J.

De Laval Pacific Company
San Francisco, Cal.

Chadburn's (Ship) Telegraph Company, Ltd., Cyprus Road, Bootle, Liverpool
Turbine Equipment Company, Toronto, Ontario, Canada
The Separator Company, Ltd., Stockholm, Sweden
Europe — Asia — Africa — South America

Sooner or later you will use a

De Laval

Please send Bulletin No. 105 containing further information regarding the De Laval Oil Purifier as checked below:

☐ Purification of turbine lubricating oil

☐ Purification of Diesel lubricating oil

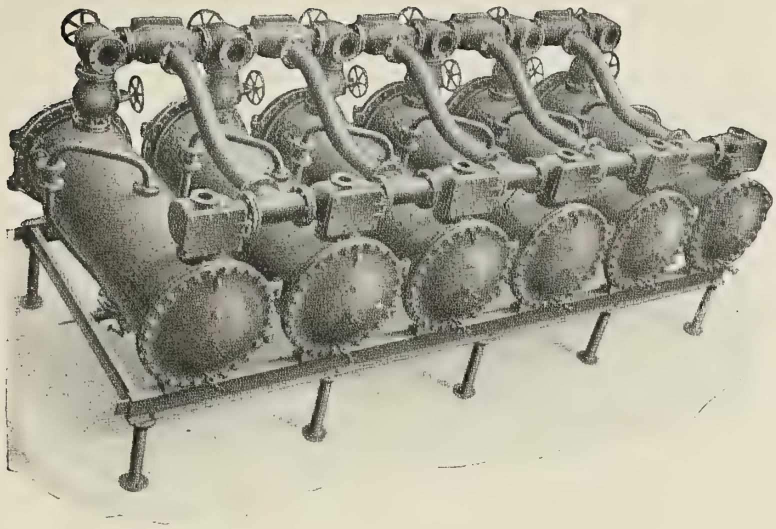
☐ Purification of fuel oil

Name ....

Company ....

Address ....

M. E.



Wheeler Sextuple Effect Evaporator

Capacity, 120 tons of distilled water a day, operates on exhaust steam and carries a vacuum on the last effect. **Copper, Brass and Bronze used throughout.**

This Evaporator Unit is 100% Copper, Brass and Bronze

Not a pound of iron in it.

For marine service, it is perfect—compact, non-corrodible, and 30 per cent lighter than if iron castings had been used.

The shell is of heavy sheet Copper. The tube header, floating head and cover plate are Bronze. The tubes are of seamless drawn Copper expanded into the tube sheets. All feed piping and brine connections are of Brass and Bronze.

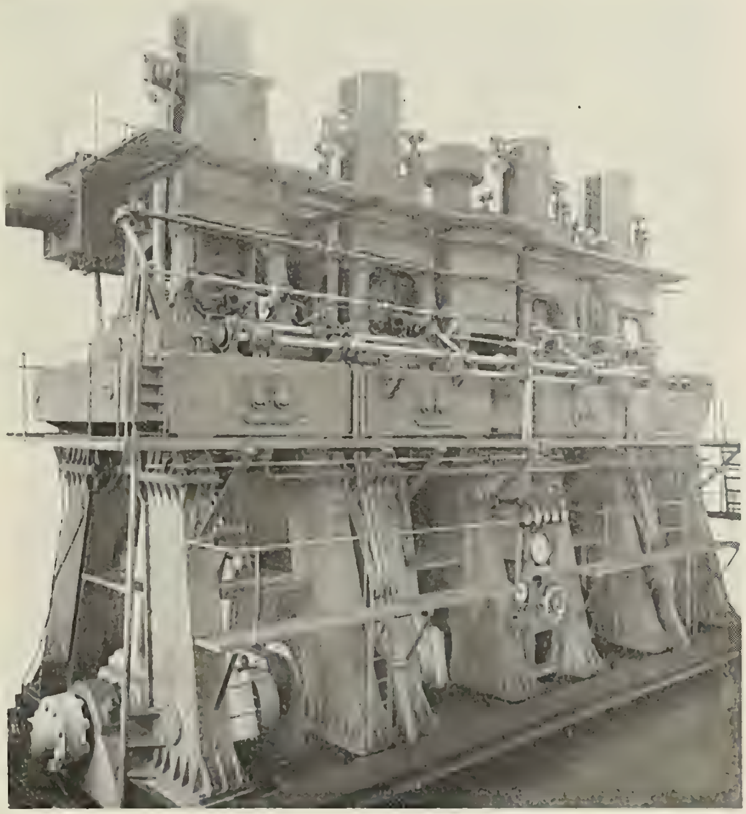
* * *

Since the first Bronze-beaked Phoenician galley breasted the seas, Copper metals have been intimately associated with the development of shipping and the advancement of naval design.

Copper, Brass and Bronze are the standard salt water metals.

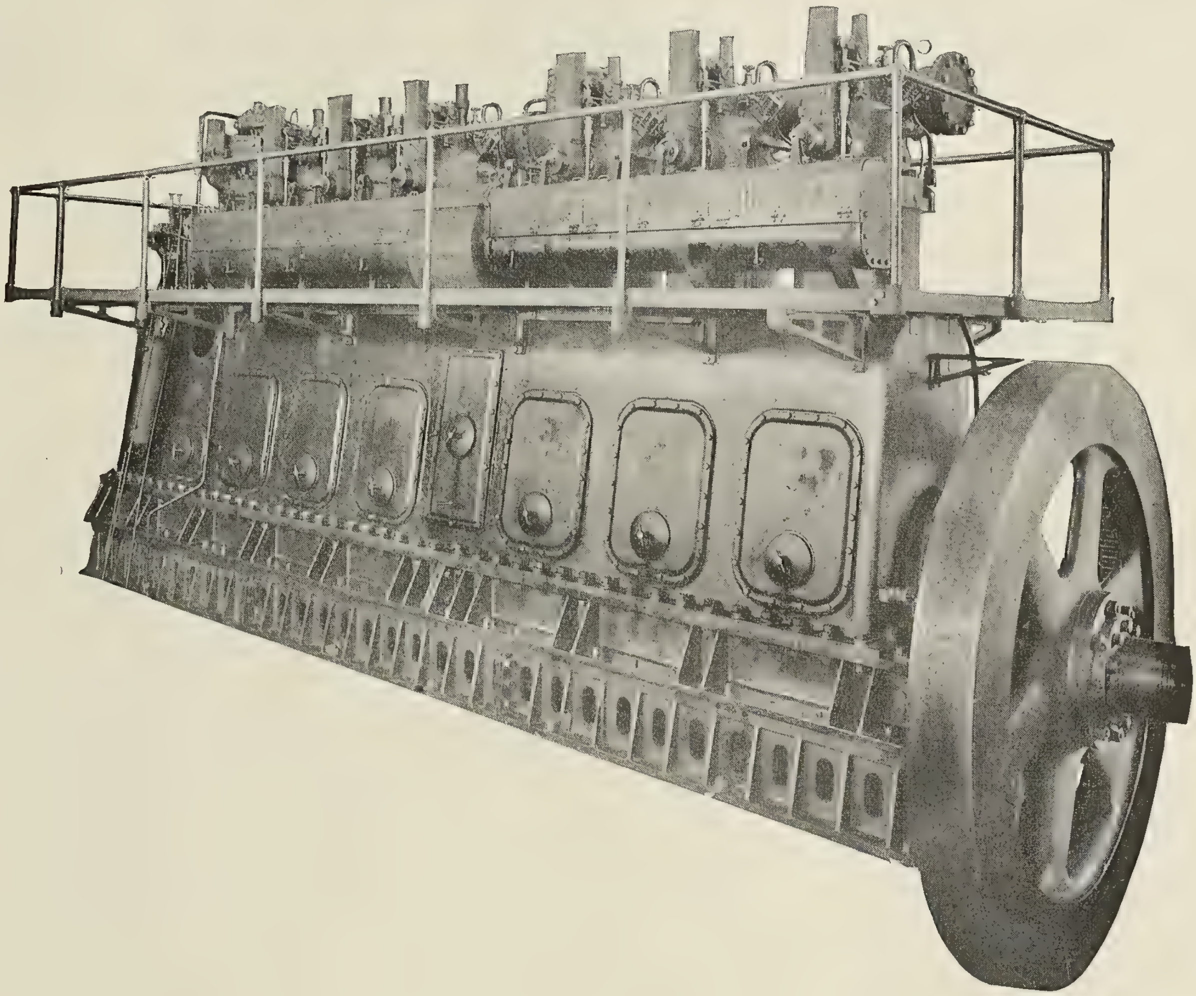
COPPER & BRASS RESEARCH ASSOCIATION

25 Broadway - New York

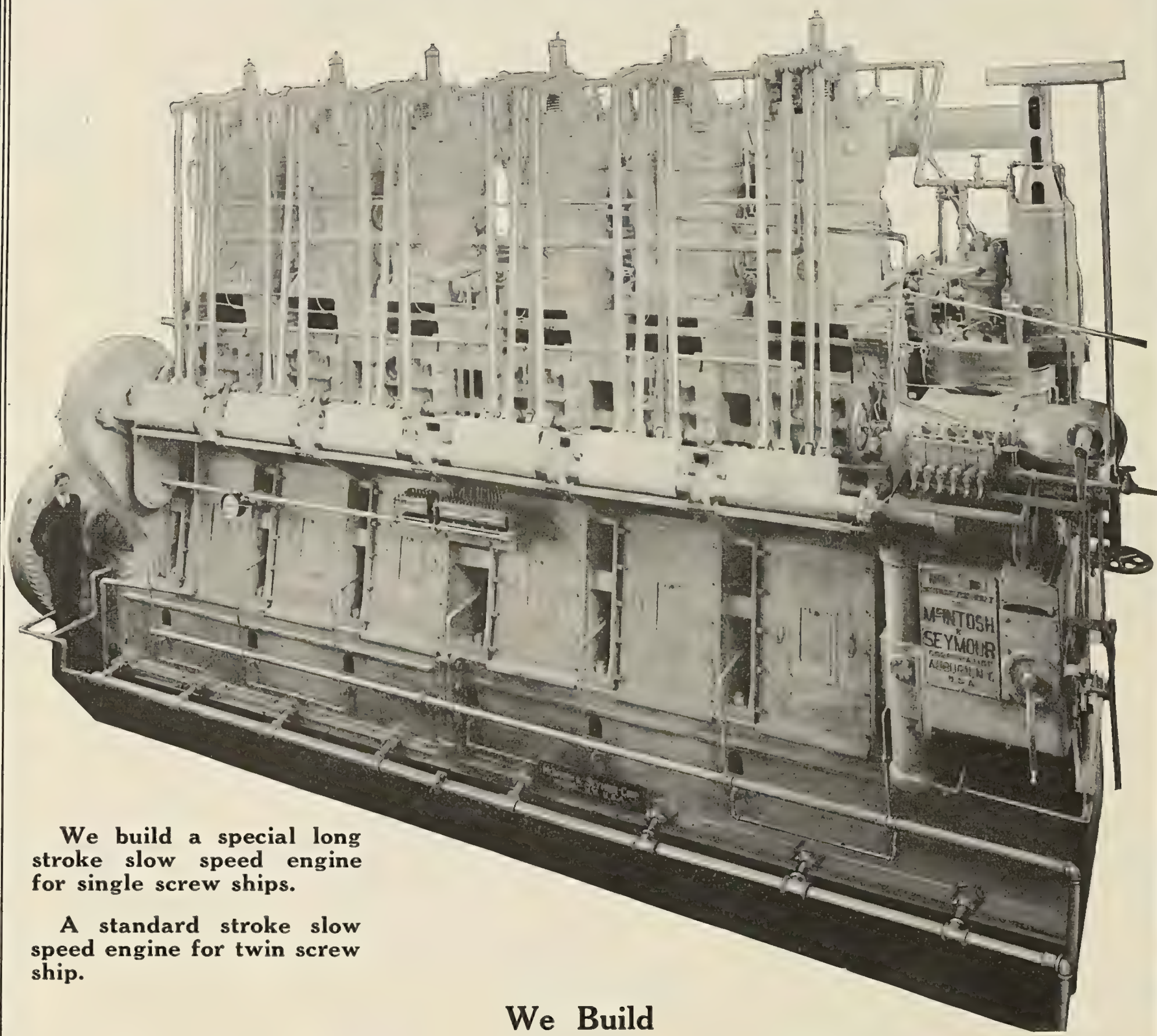


We Build Opposed-Piston Diesel Oil Engines

Airplane View of Shipyard



McINTOSH & SEYMOUR CORPORATION



We build a special long stroke slow speed engine for single screw ships.

A standard stroke slow speed engine for twin screw ship.

We Build

DIESEL MARINE ENGINES

FOR ALL CLASSES OF SHIPS

IN SIZES FROM

390 TO 4000 HORSE POWER

MAIN OFFICE AND WORKS

AUBURN, N. Y., U. S. A.

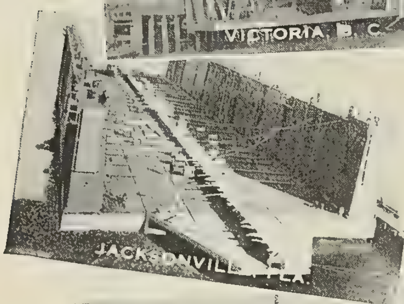
149 BROADWAY
New York City

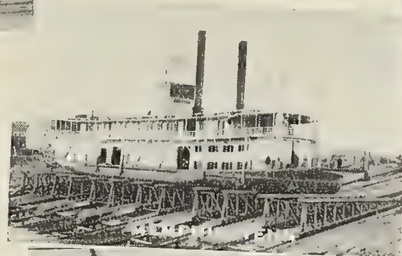
815 SHELDON BLDG.
San Francisco, Calif.

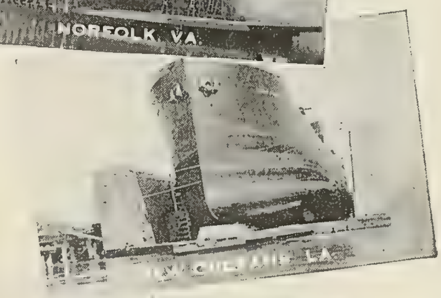
412 BISBEE BLDG.
Jacksonville, Fla.

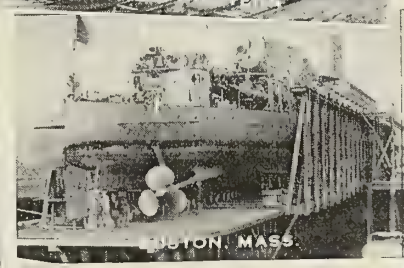
700 INTERSTATE BLDG.
Kansas City, Mo.

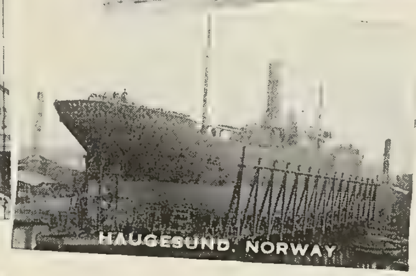
325 HUMBLE BLDG.
Houston, Texas







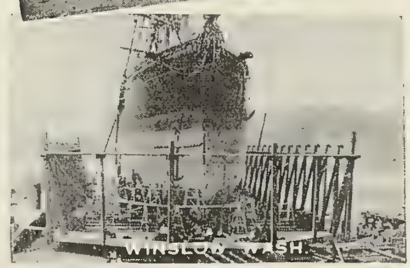




REMEMBER

Regular profits are assured by careful, sound investment. Crandall Dry Docks are based on sound engineering design and the combined experience of three generations. As a result the initial cost and operating expense are much lower per ton of lifting capacity than those of any other types. Thus you are assured of maximum return on the invested capital.

We will be glad to inform you of the locations of Crandall Dry Docks and forward descriptive pamphlets illustrating them.



THE CRANDALL ENGINEERING CO.

CONSULTING ENGINEERS CONTRACTING

BOSTON

DESIGNERS OF DRY DOCKS AND MARINE RAILWAYS

PACIFIC COAST REPRESENTATIVE – SAN FRANCISCO BRIDGE CO., SAN FRANCISCO, CAL.

When RELIABILITY is an absolute essential

The condition of a cargo of perishable foodstuff when it reaches port, depends to a large degree, upon the reliability of the refrigerating machine. The owner's chances of making or losing thousands of dollars, hinges upon the performance of the equipment which is furnishing the necessary refrigeration.

York Refrigerating Machines have demonstrated their absolute reliability by more than thirty-six years of satisfactory service, which has given them a high reputation throughout the refrigerating field.

Hundreds of vessels now plying the seven seas employ York Mechanical Refrigeration to the satisfaction of their Engineers and Owners. We invite all shipping interests to investigate the York Systems of Marine Refrigeration, and believe it will prove profitable to them.

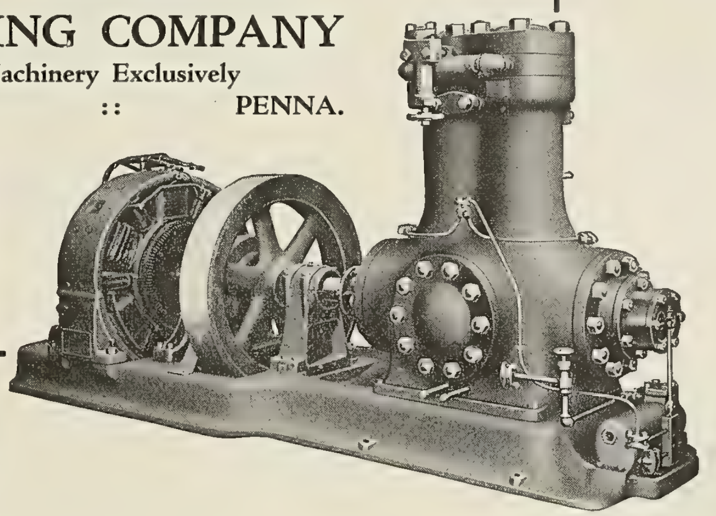
YORK MANUFACTURING COMPANY

Ice Making and Refrigerating Machinery Exclusively

YORK :: :: :: :: PENNA.

Where York Marine Service is available

Boston	Pittsburgh	St. Louis
Brooklyn	Cleveland	New Orleans
Buffalo	Chicago	San Francisco
Philadelphia	Cincinnati	Los Angeles
Baltimore	Detroit	Seattle
Toronto	Montreal	Vancouver



The machine illustrated here is a York Enclosed Type Carbonic Anhydride (CO_2) Machine, direct connected to electric motor, through extended shafts and coupling. These units can be furnished in sizes from one-half ton refrigerating capacity upwards.

"Tumble Out, Cook, and Stand by the Fore-Sheet"

He wasn't only a sea-going chef in the old square riggers, but could often be seen in his shirt sleeves and with apron flapping dodging the sprays and the wash in the lee scuppers when attending to his 'bout ship job of easing off the foresheet. Wet and cold he may have been at times, but his SHIPMATE range was there like a fond mother to alleviate his temporary discomforts.

SHIPMATES

Are Made Only By

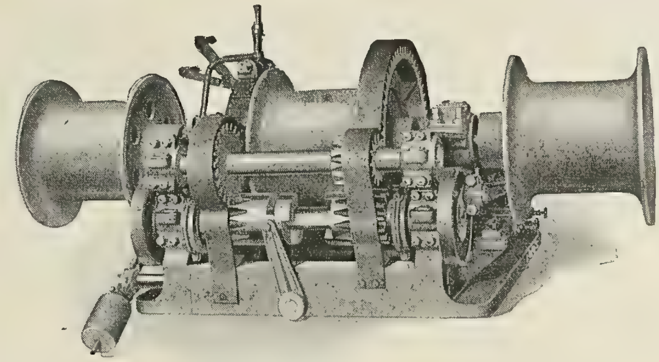
THE STAMFORD FOUNDRY COMPANY

Established 1830 STAMFORD, CONN.

LIDGERWOOD SHIPS WINCHES

Universal Ships Winch, Single Lever Control

A Child
Can
Run It



Safe
Swift
Sure

A Quiet, Little Giant for Work

Compound Gear, Two Speed.
Steel and Bronze Gearing, cut teeth.
All Around Gear Guard.
Single Gear Hoists average loads.
Compound Gear lifts heavy loads.
Gear change made instantly should steam pressure drop, or to lift the heavy loads.

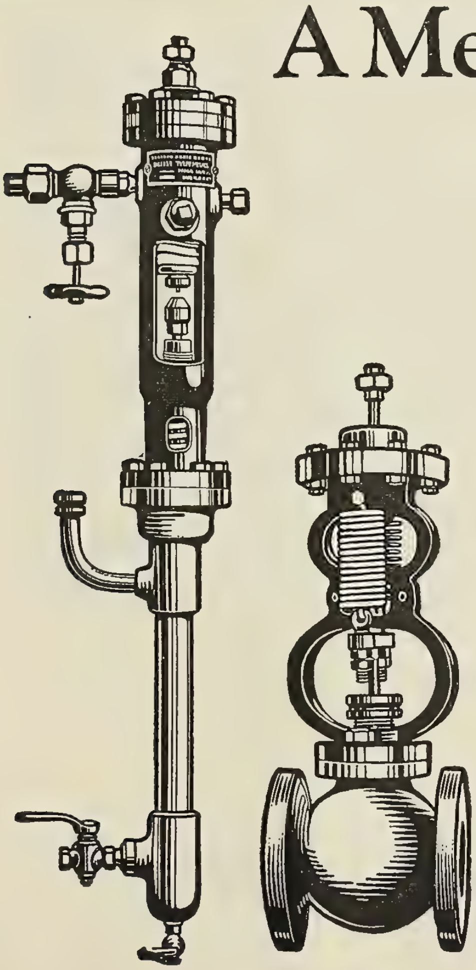
Same foundation.
Same holding down bolts.
Same steam connections as Lidgerwood single gear winches on Shipping Board Ships.
Rugged and compact.
Squared Crankshaft, no feathers.

DOCK WINCHES TOWING ENGINES STEERING ENGINES

LIDGERWOOD MFG. CO., 96 Liberty St., New York

Branches: Philadelphia, Pittsburgh, Chicago, Cleveland, Detroit, Los Angeles, Seattle, London, Eng.

A Means of Economy at Sea



Here's a simple device which marine engineers have been quick to adopt because of its steam saving.

After all, what you ask of your pump is that it bring the pressure to a certain point and then stop its work until that pressure drops, after which, it should resume again and automatically maintain the pressure at the proper point.

The Todd Differential Pump Governor does just this. When the pump's job is done it uses no more steam, wastes no more power until fresh effort is required of it.

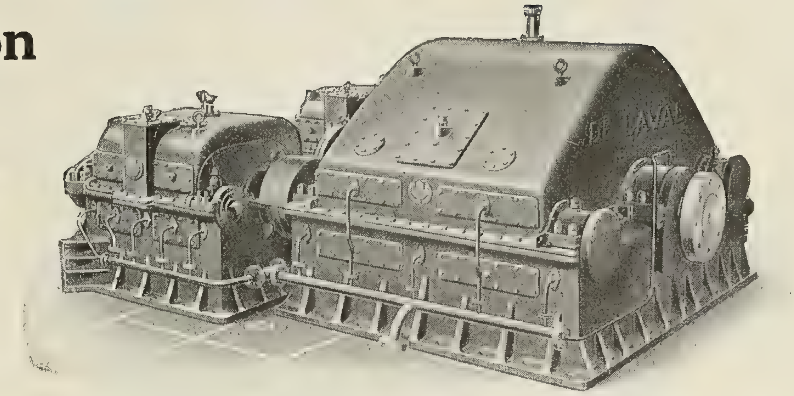
A post card will bring you full details of the Todd Governor.

TODD SHIPYARDS CORPORATION
Plant of WHITE FUEL OIL ENGINEERING CORPORATION
742 East 12th Street, New York City

TODD
NEW YORK, U.S.A.

DIFFERENTIAL
PUMP GOVERNOR

De Laval Double Reduction Gears Give Satisfaction



De Laval 6000 HP. double marine reduction gear for 110-RPM. propeller speed, supplied for installation in three twin-screw transports.

THE success of De Laval gears is due to our long experience in the design of such gears and our careful and painstaking methods of manufacture. De Laval gears are cut on gear cutters specially designed and built by the De Laval Company, as our experience has demonstrated that the ordinary commercial helical gear cutter will not permit the degree of accuracy necessary for high speed gears. All parts are made to limit gages and are interchangeable.

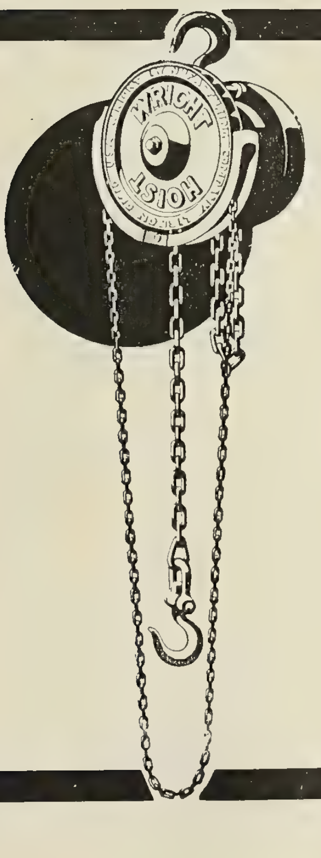
State type and size of vessel in which you are interested, and we shall be glad to send more detailed information with our publication, M-46, and a list of vessels using De Laval Geared Turbines.

DE LAVAL STEAM TURBINE COMPANY
TRENTON, NEW JERSEY

Local Offices: Boston, New York, Philadelphia, Pittsburgh, Indianapolis, Chicago, Cleveland, Duluth, Kansas City, Denver, Salt Lake City, Charlotte, Atlanta, Birmingham, New Orleans, Dallas, Seattle, San Francisco, Los Angeles, Montreal, Toronto, Vancouver

162

WRIGHT HOIST



HOIST-ABILITY

It defines everything required in an all-purpose hoist—safety, speed, ease in handling, non-fouling chain, all steel parts, and correct design.

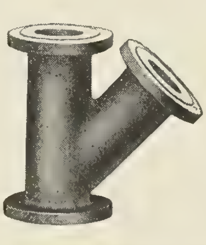
Wright High Speed Hoists embody Hoist-ability in its most highly developed form.

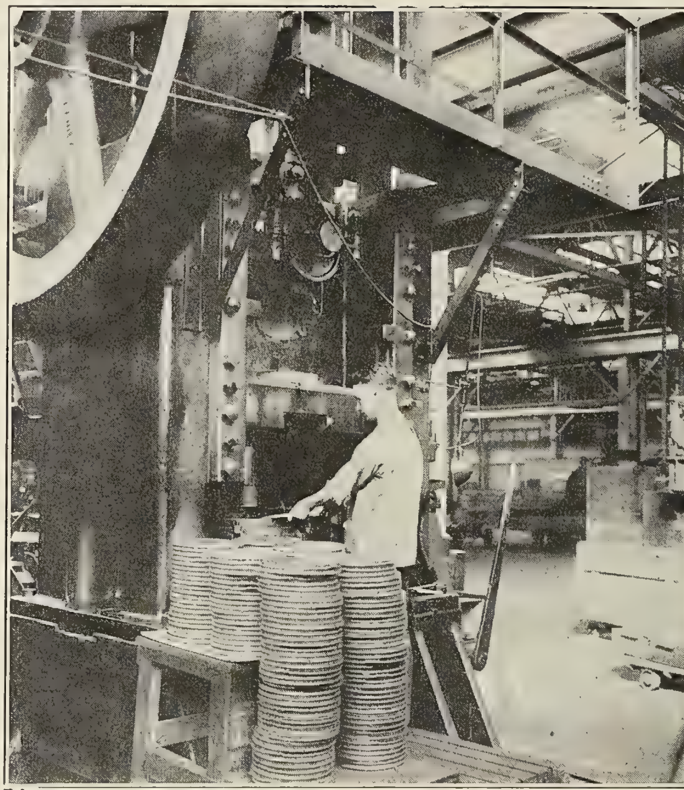
One trial will prove the point.

Our catalogue—Shall we send it?

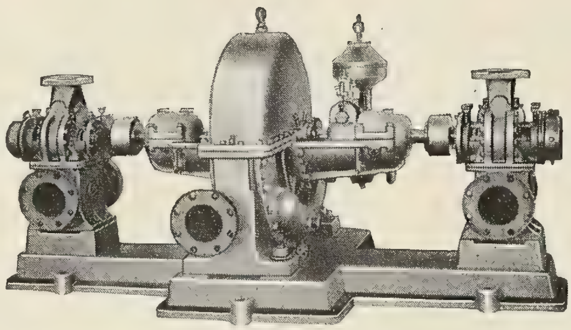
WRIGHT MANUFACTURING COMPANY

LISBON, OHIO





Northern Rotary Pumps For Marine Service



One of Two Dual Pump Units in Service on Steamship Leviathan. Used on Foamite Firefoam.

Small Space on Shipboard

is one of the primary features of Northern Rotary Pumps that are making them steadily more popular for marine service. In spite of the fact that these pumps deliver oils and water against pressures of 300 pounds and over, they take up surprisingly small space on board ship.

Lubricating oil service, fuel oil, boiler feed, bilge and sanitary, fresh water, standby fire, main cargo transfer,—are now common duties of these pumps on ships and shore service.

Furnished direct-shaft connected to common speed electric motors and slow-speed turbines for capacities ranging from 4 to 2,000 gallons per minute.

Write for Circular

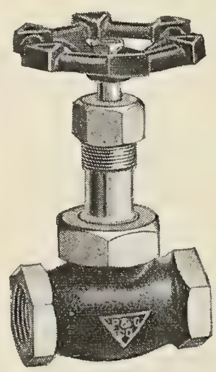
NORTHERN ROTARY PUMPS
"MORE GALLONS PER HORSE POWER"

NORTHERN FIRE APPARATUS CO.
MINNEAPOLIS, MINNESOTA. U.S.A.

51 East 42nd St. New York City	408 Balboa Bldg. San Francisco, Calif.

PRATT & CADY UNION BONNET VALVES

For 150, 200, 250 and 300 lbs. steam pressure. The 150 pound valves are made with the well known P. & C. renewable asbestos disc. For the higher pressures a solid bronze regrinding disc is furnished and the discs of the 300 pound valves have a special spiral throttling lip to protect against wire drawing.



The general design includes such features as a bevel joint at the bonnet to insure tightness, large diameter spindles of manganese bronze, coarse thread on the spindle to aid quick operation and Kool Grip hand-wheels. For severe services renewable seat rings will be furnished when specified.

Our new catalogue gives complete details.

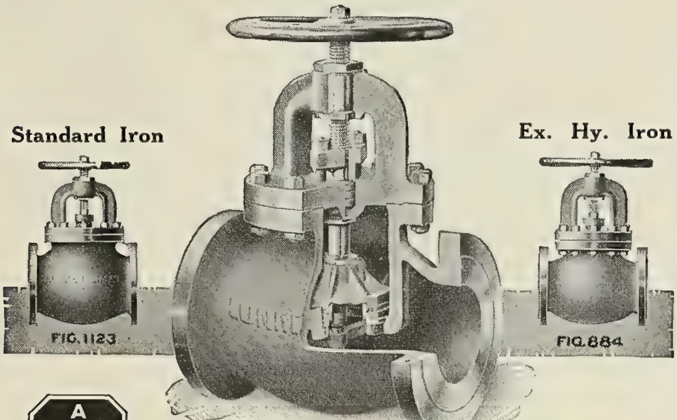
Reading Steel Casting Co., Inc.

Pratt & Cady Division

Bridgeport, Conn.

Boston	Detroit	Philadelphia
Charlotte	Hartford	Pittsburgh
Chicago	Houston	San Francisco
Cleveland	New York	St. Paul

Standard Iron Ex. Hy. Iron



A TYPE FOR EVERY PURPOSE

And Service 'way beyond the average!

Be it a small or large size for low or high pressures and temperatures, there is a Lunkenheimer Valve especially suited to the purpose. Every type is designed to give maximum service under extreme operating conditions, and with the line complete, standardization with its many advantages, is easily accomplished.

With seating surfaces regrindable and all parts made to gauge and renewable, repairs can easily be made should necessity require. The installation of Lunkenheimer Valves means permanence in the line, with maintenance expense reduced to a minimum.

Our Catalog No. 58-BE illustrates and describes the various types in detail. Shall we send you a copy?

Fig. 1021
"Ferrenewo"
Iron body Renewable "Valve-Nickel" Seat and Disc

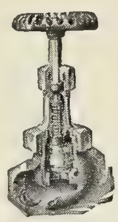


Fig. 73
"Renewo"
Bronze Body Renewable "Valve-Nickel" Seat and Disc

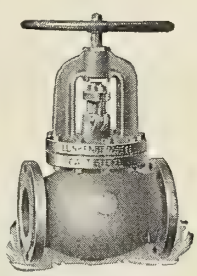


Fig. 606
Cast Steel

"America's Best since 1862"

THE LUNKENHEIMER CO.
"QUALITY"

LARGEST MANUFACTURERS OF
HIGH GRADE ENGINEERING SPECIALTIES
IN THE WORLD

NEW YORK CHICAGO **CINCINNATI, U. S. A.** BOSTON LONDON

EXPORT DEPT. 129-135 LAFAYETTE ST., NEW YORK

1300-20M-25

LUNKENHEIMER

Can You Refuse?

EVERYWHERE you see the ravages of Consumption. There were 1,000,000 cases and 100,000 deaths from this scourge last year. But if all that see these words will help,

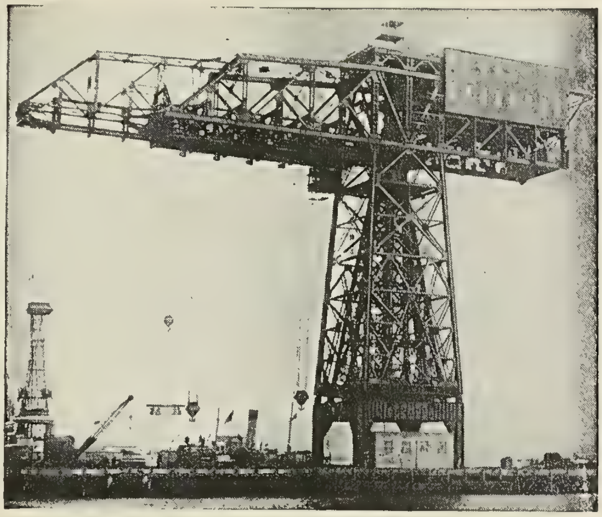
It can be stamped out

Buy the Tuberculosis Christmas Seals where you see them sold. (A picture of one is below.) The revenue from these sales is devoted to a great organized campaign against Tuberculosis. This campaign gives the service of doctors and nurses to millions of the stricken. It organizes local associations. It carries on educational work in schools and offices and factories. You cannot help in a nobler work. Join it. Buy the seals.

Stamp out Tuberculosis with Christmas Seals

THE NATIONAL, STATE, AND LOCAL TUBERCULOSIS ASSOCIATIONS OF THE UNITED STATES

The Largest Shipbuilding Crane



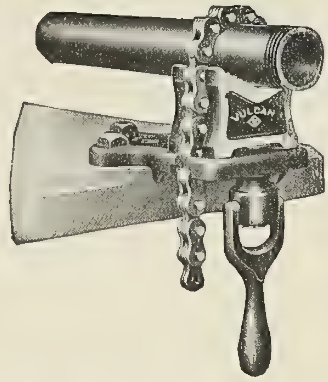
This crane is in the League Island Navy Yard, Philadelphia, and has an operating capacity of 350 gross tons at 115 ft. radius. Our success in designing and building this unusual crane should inspire your confidence in our ability.

We also manufacture Locomotive Cranes, Clam Shell Buckets, Coal and Ore Handling Machinery, Car Dumpers, Pile Drivers, Derrick Cars and a complete line of Shipbuilding Machinery consisting of Gantry Cranes, Bridge Cranes, Hammerhead Cranes, both of the stationary and traveling type. **Consult us when in the market.**

The McMyler Interstate Co., Cleveland, Ohio

New York City, 1756 Hudson Terminal Building.
Chicago, Illinois, 812 Edison Building.
Seattle, Washington, Hoge Building.
Denver, Colorado, 18th and Wazee Streets.
San Francisco, California, 766 Folsom Street.
Birmingham, Alabama, Brown-Marx Building.

SB-25



Better Tools
make better workmen

You can't buy better pipe tools than Williams' "Vulcan" Drop Forged Chain Pipe Wrenches and Vises.

Wrenches—8 sizes for 1/8 to 18″ pipe.

Vises—3 sizes for 1/8 to 8 in. pipe.

Literature on request

J. H. WILLIAMS & CO.

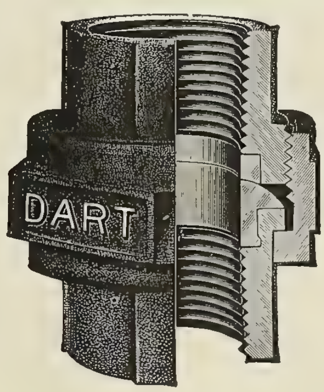
"The Drop-Forging People"

BROOKLYN	BUFFALO	CHICAGO
63 Richards St.	63 Vulcan St.	1063 W. 120th St.

Two Bronze Spherical Seats in combination with Malleable Pipe Ends give the

DART UNION

a distinctive feature which has been unequaled. It is the acknowledged leader.

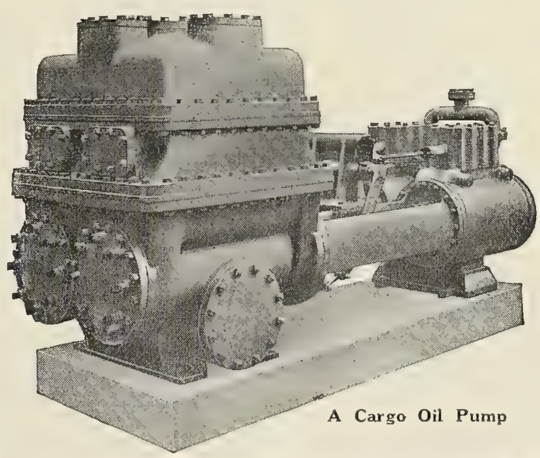


E. M. DART MFG. CO., Providence, R. I.

THE FAIRBANKS CO. & BRANCHES, Distributors

Canadian Factory
DART UNION CO., Ltd., Toronto

TRANSIT



A Cargo Oil Pump

A dependable pump, used on many tankers with great success. Capacity range from 546 to 2250 Bbls. per hour. Pressure up to 200 lbs.

A Cargo Oil Pump with separate valve plates and removable liners, known as the "Newport" type.

We also build pumps for other services aboard ship—Boiler Feed Pumps—Lubricating Oil Pumps—Transfer Pumps—Bilge and Ballast Pumps—Sanitary Pumps—Cooling Pumps, Etc.

National Transit Pump and Machine Company
OIL CITY, PENNA.

DISTRICT OFFICES:
New York Philadelphia Pittsburgh Kansas City
Cleveland Houston Denver

There are many veterans in the BRIGGS-COATED FLEET, and all are protected by

Briggs Bituminous Coating

(Solution, Enamel and Cement)

They sail on many seas and under many flags. In size, they range from a tug boat to the Q. S. S. Majestic. But they are all assured of protection for years to come.

Briggs Coatings—Solution, Enamel and Cement—are Permanent. They save yearly scaling and repainting, and add many years to the life of the vessel.

Is your fleet protected against its worst enemy—RUST?

Among the Vessels Coated with Briggs Materials are:

S. S. Katrina Luckenbach	S. S. China Arrow
S. S. George W. Barnes	S. S. Japan Arrow
S. S. W. L. Stead	S. S. India Arrow
S. S. Nantasket	S. S. Nava Arrow
S. S. Cohasset	S. S. Agwibay

S. S. J. Fletcher Farrell

BRIGGS

Briggs Bituminous Composition Co.
Incorporated
17 Battery Place, New York City, N. Y.
(Home Office)

303 Finance Building, Philadelphia, Pa.
223 Colman Building, Seattle, Washington
Dundee, Scotland

BATH IRON WORKS, Ltd.

STEEL SHIPBUILDERS AND ENGINEERS

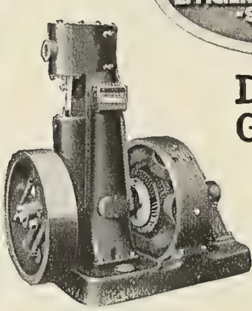
BUILDERS OF

Cargo Steamers—Oil Tankers—
Coastwise Passenger Steamers—
Steel Steam Yachts
Marine Boilers
Normand Water Tube Boilers.
Licensees for
Parsons Marine Steam Turbines.

This company has been very successful in building high speed vessels for the United States Navy and for private owners.

New York Office, 23-31 West 43rd St.
WALTER A. MURTAUGH, Representative
Telephone
Murray Hill 0778

Engberg
THE STANDARD FOR EFFICIENCY-DURABILITY-SERVICE



1 to 50 K. W.

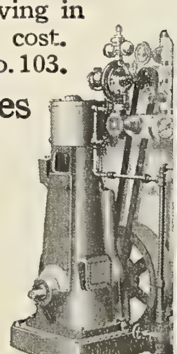
Direct Connected Generating Sets

ENGBERG Customers are universal in their expression of satisfaction, and as to the big saving in operating cost. Catalog No. 103.

Vertical Steam Engines

A combination of superior design, materials and workmanship—an ideal formulated on thirty years' experience in the manufacturing and testing of Vertical Steam Engines. Catalog No. 301.

HIGHEST QUALITY
ATTRACTIVE PRICES

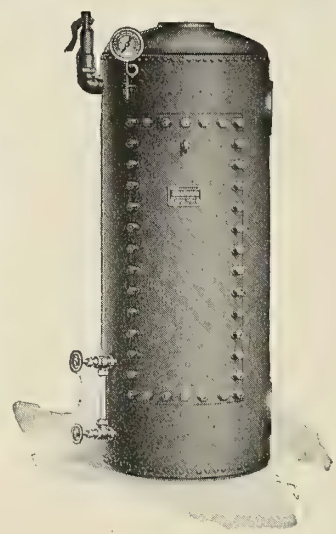


1 to 100 H.P.

MANUFACTURED BY
ENGBERG'S
ELECTRIC & MECHANICAL WORKS
6 VINE ST., ST. JOSEPH, MICHIGAN, U.S.A.

THE R & D PARACOIL

Feed Water Heater



Constructed with cast iron or steel plate shells, with coils of a very high thermal efficiency. Improved cleaning facilities make maintenance expense low.

Write for catalogue and complete information.

Row & Davis Engineers, Inc.

Consulting and Contracting Engineers

Evaporators, Feed Water Filters, Grease Extractors, Distillers, Ash Ejectors, Condensers, Fresh Water Stills, Fuel Oil Heaters, Oil Coolers, R & D Gravity Flow Filters and Inspection Tanks, RanD System for Bunker Oil

90 WEST STREET NEW YORK
Cable Address: Roviseng, New York

PHILADELPHIA OFFICE: 902 Liberty Building
SAN FRANCISCO: Jenkins-Miller Co., 48 Clay Street
SEATTLE: V. S. Jenkins Co., 303 Railroad Ave., S.
TORONTO: Storey Pump & Machinery Equipment Co., Excelsior Life Bldg.

Cap'n Allswell Says:

"A Hard Driving Propeller is Like Lead Soles On Your Boots"

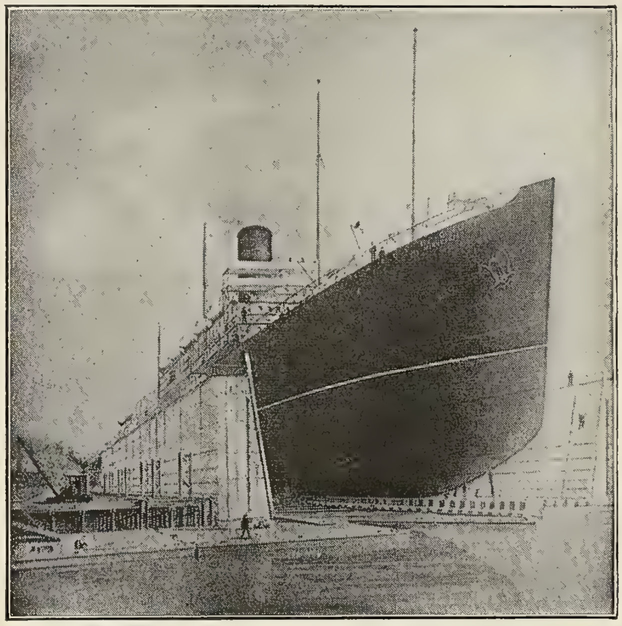
"It uses up power and hampers speed. If you want to cut down fuel costs or reduce running time, equip with perfectly balanced, easy twirling Columbians. Let me send you the Columbian Book; it's full of sound, practical propeller talk."

THE
COLUMBIAN
BRONZE
CORP.
220 N. Main Street
Freeport, N. Y.

For N. Y. C. Sales Only:
44 Third Ave.

TRADE MARK REGISTERED

COLUMBIAN
Bronze PROPELLERS

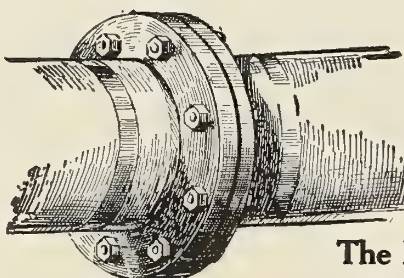


SIZES of DRY DOCKS
DESIGNED, BUILT and in OPERATION

150. Tons	5000. Tons
1250. "	6000. "
1500. "	8000. "
2000. "	10000. "
3500. "	12000. "
4500. "	20000. "

DONNELLY DRY DOCK CO., INC.
Designers and Engineers

17 BATTERY PLACE NEW YORK, N. Y., U. S. A.



The Pipe Is Out of Line — BUT

The GOETZE GASKET Is Holding Tight

Even if the pressure is high with a poor job in pipe fitting you can make any joint tight with a Goetze Gasket.

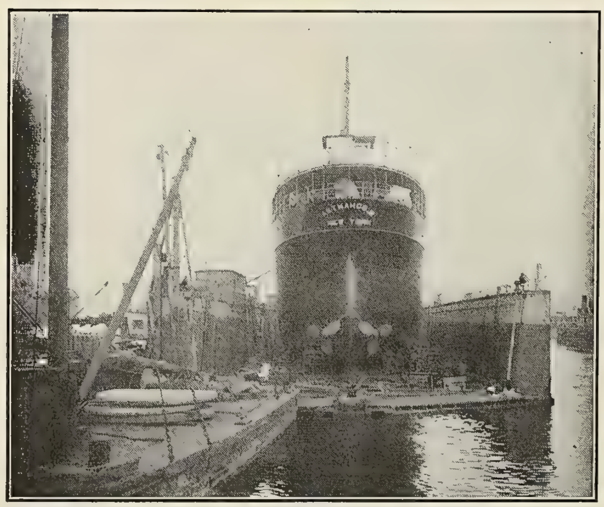
The resilient deep corrugation in the copper or other metal and the spun asbestos rings take care of that. They remain in perfect contact with the flange surface, regardless of expansion and contraction.

Goetze Gaskets last as long as the pipe line. You can remove them and re-use them with assured tightness.

We are ready now to convince you that Goetze Gaskets, Goetzerit Sheet Packing and Goetze Valve Discs are unbeatable in any service. A 90 days' free trial allowed.

GOETZE GASKET & PACKING CO.
24 Allen Avenue
New Brunswick N. J.

MARINE REPAIRS



SHIPYARD - - DRY-DOCKS
Steel and Wood Construction
ENGINES — BOILERS — TURBINES

VULCAN IRON WORKS, INC.
JERSEY CITY, N. J.

Twenty Distinct Types of Ships

The shipyard of the Merchant Shipbuilding Corporation holds the remarkable record of having constructed twenty distinct types of ships during the past sixty-three years:

Motor Ships,	*Colliers,*
Passenger and Freight Ships,	*Passenger Side Wheelers,*
Freight Ships,	*Tugs,*
Oil Tankers,	*Mine Sweepers,*
Steam Yachts,	*Cruisers,*
Barges,	*Sloops o' War,*
Ferry Boats,	*Monitors,*
Dispatch Boat,	*Gunboats,*
Patrol Boat,	*Fire Boats,*
Sailing Ships,	*Water Boats.*

We will continue to give the same careful attention to specifications and construction which has marked our achievements in the past.

Our quotations on new construction or repair work will interest you.

Ask for our Register of Contracts.

Merchant Shipbuilding Corporation

Chester, Penna., or 39 Broadway, New York

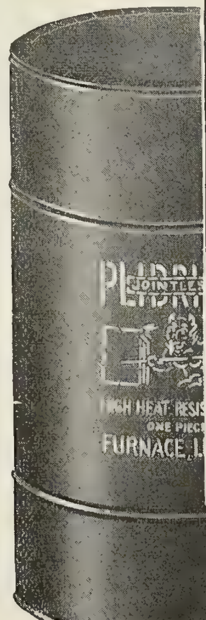
PLIBRICO is sold only in containers of distinctive appearance as shown below.

Here's *your* furnace lining—

PLIBRICO

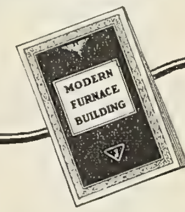
FURNACE LINING

A PLASTIC refractory in unbaked form that conforms to all furnace shapes and can be installed by anyone who can use a mallet. This steel container keeps it in perfect condition and identifies the only "Jointless Fire Brick"—the one-piece refractory lining that outlasts ordinary fire brick from 2 to 4 times and resists temperature to 3100°F. The way to better furnace linings is the subject of the new booklet. Where shall we send it? Warehouse stocks in principal cities.



JOINTLESS FIRE BRICK CO.
1152 CLAY ST. CHICAGO, ILL.

Ask for this Booklet.



Wilmer H. Johnson, President; Ellis J. Stearns, Sec'y-Treasurer; Warren Johnson, V. P. & Gen. Mgr.; Eads Johnson, V. P., 115 Broadway, New York

JOHNSON IRON WORKS DRY DOCK & SHIPBUILDING CO., INC.

Operating

DRY DOCKS 5,000, 2,000, 250 tons Cap.

and

MARINE REPAIR PLANT

Algiers Station

Construction Yard, Bayou St. John

Builders of

Tugs, Barges and River Steamboats

New Orleans, Louisiana

Lumber and Timber

OF EVERY DESCRIPTION

For Use In Marine Work

Your requirements for light or heavy ship construction and repairs, ship yards, docks and buildings will be promptly met.

Furnished in any shape or size to suit individual needs.

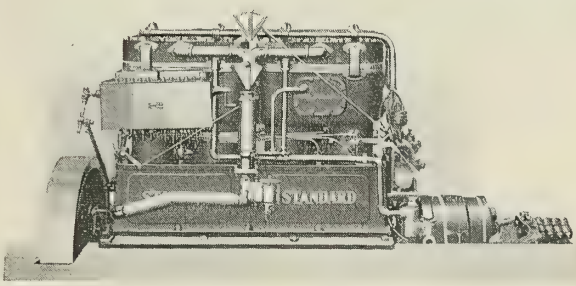
The John C. Orr Co.

Established 1868

Docks—Mills—Yards—on the East River

BROOKLYN NEW YORK

The STANDARD Engine is in the motor life boats of The "Leviathan"



With this engine in these motor life boats each is a real little mother-ship to the rest of the life boat fleet; capable of caring for them in an emergency, towing them to safety, or keeping them from becoming separated while constantly calling for aid with powerful radio.

The encouragement and security that such little motor boats (STANDARD equipped) afford to the ocean giant's passengers are priceless.

Back of the STANDARD guarantee is

The Standard Motor Construction Company

176 WHITON STREET JERSEY CITY, N. J.

Arthur Tickle Engineering Works,

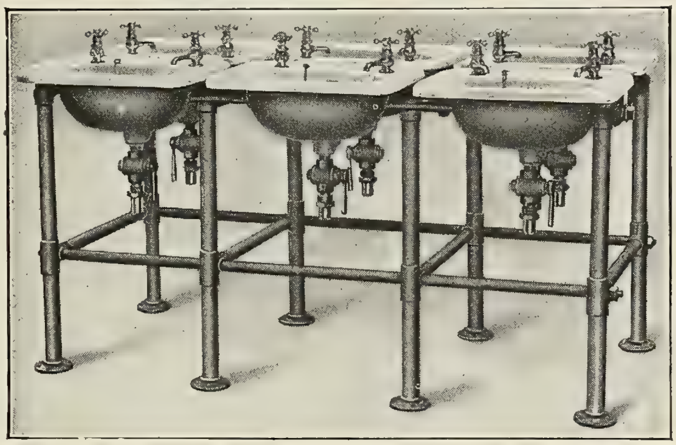
ENGINEERS—MACHINISTS—BOILERMAKERS—BLACKSMITHS

Marine Repairs

Forgings, Castings, Plate Work, Carpenter and Joiner Work

Main Office and Works

DELEVAN ST., BROOKLYN, N. Y. Telephone Henry 0565



SANDS N. Y.

GUARANTEED

Marine Plumbing

1922 "The Standard by Which All Other Makes Are Measured"

An ideal enameled iron lavatory combination supported on iron pipe frame, fitted with white metal faucets and brass lever handle waste cocks. For use in 3rd class and crew's quarters. Can be furnished in units of two and up. Strong, durable and highly sanitary. We invite all inquiries.

A. B. SANDS & SON COMPANY

22-24 Vesey Street New York, N. Y.

S3222

BITUMASTIC
REGISTERED TRADE MARK

HERMASTIC
REGISTERED TRADE MARK

BITUMINOUS COATINGS

for

Bilges, Tank Tops, Coal Bunkers, Inner Bottom Tanks, Floors, Peaks, Refrigerating Spaces

WAILES DOVE—HERMISTON CORPORATION

FORMERLY

AMERICAN BITUMASTIC ENAMELS COMPANY

17 BATTERY PLACE, NEW YORK

PHILADELPHIA CLEVELAND

PROFESSIONAL DIRECTORY

CONSULTING AND MARINE ENGINEERS, NAVAL ARCHITECTS
MARINE SURVEYORS, PATENT ATTORNEYS, ETC.

CHAPMAN & FISHER

Consulting Engineers and Naval Architects

Designs, supervision, surveys and Appraisals for merchant vessels and all types of floating equipment.

524 WALNUT ST. PHILADELPHIA, PA.
Phone Lombard 5408-09

CHRISTENSEN & SNETHLAGE

Naval Architects and Engineers

Surveyors—Shipbrokers
Motorships, Motortugs, Motorbarges

CUNARD BUILDING NEW YORK CITY
Tel. 3154 Bowling Green.

Irving Cox Bruno Tornroth Daniel H. Cox Thomas C. Landi

COX & STEVENS

CUNARD BUILDING—25 BROADWAY, NEW YORK
(Morris Street Entrance)

Naval Architects, Marine Engineers, Consulting Engineers

Ship and Engineer Surveyors and Appraisers, Ship Brokers
Cable address: "Brokerage" Telephone: Whitehall 2700

THEODORE E. FERRIS

Naval Architect and Marine Engineer

Hudson Terminal Building, 30 Church St.
'Phone, 2786 Cortlandt :: New York
Plans, Specifications and Superintendence, Steamships, Steamboats, Tugs, Etc.

R. S. Griffin, Washington, D. C. W. L. Cathcart, New York, N. Y.

GRIFFIN AND CATHCART

Consulting Engineers
Marine and Naval Engineering

Investigations, Reports, Opinions, Expert Testimony

149 Broadway New York

ALFRED H. HAAG

Naval Architect and Marine Surveyor Designer

Specifications and Supervision of Steam Ships
Specialists in
Cargo Handling Gear

406 WATER STREET BALTIMORE, MD.

ROBERT S. HAIGHT

J. MCDONALD G. B. HARGAN

Ship and Engineer Surveyor, Consulting Engineer

SUPERVISION, APPRAISALS, EXPERT TESTIMONY

BOWLING GREEN 6438 17 STATE STREET, NEW YORK
Cables "Shipeng, N. Y."

JOHN B. MATTHEWS

Consulting Engineer Naval Architect

Plans, Specifications, Supervision for all Types of Vessels.
Reports, Installations, Repairs, Etc.

24 California Street Tel., Sutter 1785
SAN FRANCISCO, CAL.

C. P. MOON

Marine Engineering—Reports
Surveys—Designs

Cunard Building New York City
Telephone—Bowling Green 3356

WALTER E. POMMER

Naval Architect Ship Broker

Plans, Specifications and Estimates
Construction Supervised
Shoal Draft Vessels a Specialty

BRUMDER BUILDING MILWAUKEE, WIS.

ROSSELL & THAYER

Naval Architects and Marine Engineers

Marine Construction and Engineering Designers and Supervisors. Ship, Engineer and Cargo Surveyors.

Forrest Building, 119 S. Fourth St.

Cable Address "SEAWORTHY" PHILADELPHIA Telephone LOMBARD 5248

GEORGE G. SHARP

Naval Architect—Engineer
Marine Surveyor

30 Church Street New York City
GEORGE G. SHARP A. E. SAUNDERS

Mercantile Marine Construction and Engineering
Design — Supervision — Survey

Tel. Cortlandt 5134 Cables SEACRAFT, New York

J. MURRAY WATTS

Member of Society of Naval Architects and Marine Engineers

136 South Fourth St., Philadelphia, Penna.

Plans and Specifications furnished for seagoing and inland waterway types of commercial vessels. Also for steam and sailing yachts and motor boats.

PHONE: LOMBARD 2072 CABLE ADDRESS: MURWAT

WHITTELSEY & WHITTELSEY

Naval Architects; Marine Engineers

for construction of commercial vessels

Surveyors, Appraisers

17 BATTERY PLACE, NEW YORK CITY
Telephone—Whitehall 1414

PROFESSIONAL DIRECTORY

CONSULTING AND MARINE ENGINEERS, NAVAL ARCHITECTS MARINE SURVEYORS, PATENT ATTORNEYS, ETC.

Positions Vacant **Get Together Department** Positions Wanted

USED MARINE EQUIPMENT

Classified Advertisements—Help and Situation Wanted advertisements appearing in the "Get Together Department," 5c. a word an insertion. Minimum charge $1.00 for each insertion. For Sale advertisements $6.00 a column inch (1" by 3½" wide). Any number of inches may be used. Copy must be in this office by the 10th of each month preceding to insure insertion in the issue.

HELP WANTED

WANTED—Draftsman, thoroughly familiar with the design and construction of 200 to 300 ft., steel, moderate draft, fast combination passenger and express, and freight river vessels, with steam or Diesel Drive. Must be familiar with speed, stability, weight, and other calculations as well as construction, details and arrangements. State pay expected and full experience, education, and send examples of work in first reply. Ralph E. Winslow, River St., Atlantic, Mass.

POSITION WANTED

YOUNG Scotchman, 22½ years, desires a position as sea-going Junior Engineer. Having six years' practical engineering experience, also having College certificates in engineering drawing. Andrew Brown, 802 South Pershing Ave., Indianapolis, Ind.

SHIPYARD EXECUTIVE—Fifteen years' experience both technical and practical, graduate engineer, will consider change to allied line. Personal interview desired. Address Box 146, Marine Engineering, Woolworth Building, New York City.

DESIGNER AND ESTIMATOR, graduate naval architect, with twelve years' practical experience as draftsman, designer, and estimator, latter part in full charge of all technical and inspection work steel shipyard, also some experience wood construction. Will consider partnership consulting work, or responsible position offering reasonable permanence. Address Box 147, Marine Engineering, Woolworth Building, New York City.

GRADUATE Naval Architect with 12 years' practical experience, experienced in motorship design and operation, desires connection where such experience can be utilized. Address Box 148, Marine Engineering, Woolworth Building, New York.

EDUCATIONAL

POWERING OF VESSELS. A Practical Course of Instruction by Correspondence. Address for particulars and terms, Box C. I. D., "MARINE ENGINEERING," 34 Victoria Street, London, S. W. 1, England.

Let us help you find the right man or position.

A "Want Ad" on this page

BRINGS RESULTS.

BUYERS' DIRECTORY

Accessories, Boat
(See Boat Accessories)

Acetylene Apparatus
(See Oxy-Acetylene Welding and Cutting)

Acetylene—Dissolved
Linde Air Products Co., The

Air Aftercoolers
Alberger Pump & Condenser Co.
Ingersoll-Rand Co.

Air Chambers
National Tube Co.

Air and Circulating Pumps
Davidson Co., M. T.
Warren Steam Pump Co.

Air and Compressor Pumps
(Combined)
Davidson Co., M. T.
Westinghouse Electric & Mfg. Co.
Worthington Pump & Machinery Corp.

Air Compressors
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Air Couplings
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co.
Ingersoll-Rand Co.
National Tube Co.

Air Drills
(See Pneumatic Tools)

Air Hammers
(See Pneumatic Tools)

Air Hoists
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Air Hose
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co., The
Ingersoll-Rand Co.

Air Hose Fittings
Cleveland Pneumatic Tool Co.
Ingersoll-Rand Co.

Air Motors
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co.
Ingersoll-Rand Co.

Air Planers
(See Pneumatic Planers)

Air Ports
Sands, A. B., & Son Co.
Tiebout, W. & J.
Steward Davit & Equipment Corp.

Air Pumps
Alberger Pump & Condenser Co.
Davidson, M. T., Co.
Ingersoll-Rand Co.
Warren Steam Pump Co.
Westinghouse Electric & Mfg. Co.
Wheeler Manufacturing Co.
Worthington Pump & Machinery Corp.

Air Pumps—Vertical Twin Beam
Davidson Co., M. T.
Warren Steam Pump Co.

Air Separators
Griscom-Russell Co.

Air Valves
Cleveland Pneumatic Tool Co.
Powell Co., The William

Alarms
(See Water Gauges and Alarms)

Alcohol Engines
Standard Motor Construction Co.

Aluminum Castings
(See Castings, Aluminum)

Ammeters
(See Electrical Instruments)

Ammonia Fittings
Brunswick Refrigerating Co.
Frick Co.
Reading Steel Valve & Fittings Co.
York Manufacturing Co.

Ammonia Packing
Crane Co.
Goetze Gasket & Packing Co.

Ammonia Valves
Frick Co.
York Manufacturing Co.

Anchor Chains
(See Chains)

Anchors
American Engineering Co.
American Steel Foundries
Kearfott Engineering Co.

Anchor Trippers
American Engineering Co.

Angle Furnaces
(See Oil Furnaces)

Angle Valves
Cleveland Pneumatic Tool Co.
Crane Co.
Lunkenheimer Co., The
Powell Co., The William
Pratt & Cady Co., Inc.

Anti-Corrosive Paint
(See Anti-Rust Coatings)

Anti-Rust Coatings
Briggs Bituminous Composition Co., Inc.
Wailes Dove-Hermiston Corp.

Arches
Egan Ref. Eng. Co., Inc., T. G.

Arc Welding
(See Welding, Electric)

Asbestos Packing
(See Packing Asbestos)

Ash Ejectors
Davidson Co., M. T.
Marine Decking & Supply Co.
Row & Davis, Engineers, Inc.

Ash Hoists
American Engineering Co.
Hadfield-Penfield Steel Co.
Hyde Windlass Co.
Ingersoll-Rand Co.
Lidgerwood Manufacturing Co.

Asphalt Paint
Wailes Dove - Hermiston Corp.

Attorneys-At-Law
Ansell & Bailey.

Automatic Fire Alarms
(See Fire Alarms)

Automatic Injectors
Lunkenheimer Co., The

Automatic Towing Machines
(See Towing Machines)

Back Pressure Valves
Griscom-Russell Co.

Ballast Pumps
Davidson Co., M. T.
Ingersoll-Rand Co.
Northern Fire Apparatus Co.
Warren Steam Pump Co.
Worthington Pump & Machinery Corp.

Barges
American Bridge Co.
Charleston Dry Dock & Machine Co.
Johnson Iron Works, Dry Dock & S. B. Co., Inc.

Barge Derricks
Lidgerwood Manufacturing Co.

Barometers
Taylor Instruments Co.

Bath Pumps
Sands & Son Co., A. B.

Bath Tubs
Crane Co.
Sands, A. B., & Son Co.

Beading Machines
The Quickwork Co.

Bearings
(See Ball Bearings and Roller Bearings)

Bench Tools
Brubaker, W. L., & Cro.
Williams & Co., J. H.

Bending Rolls
(See Rolls)

Bilge Pumps
Alberger Pump & Condenser Co.
Davidson Co., M. T.
DeLaval Steam Turbine Co.
Kerr Turbine Co.
Northern Fire Apparatus Co.
Sands, A. B., & Son, Co.
Tiebout, W. & J.
Warren Steam Pump Co.
Worthington Pump & Machinery Corp.

Bitts
American Engineering Co.
Hyde Windlass Co.

Bituminous Coatings
Briggs Bituminous Composition Co., Inc.
Wailes Dove-Hermiston Corp.
Red Hand Composition Co., Inc.

Blocks
(See Chain Hoists and Blocks; also Tackle Blocks)

Blowers
(Also see Soot Blowers)
De Laval Steam Turbine Co.
General Electric Co.
Kearfott Engineering Co.
Kerr Turbine Co.
Westinghouse Electric & Mfg. Co.

Blow-Off Valves
Crane Co., The
Lunkenheimer Co., The
Powell Co., The William
Pratt & Cady Co., Inc.

Boards, Composition
Pantasote Co.

Boat Accessories
Sands, A. B., & Son Co.
Steward Davit & Equip. Corp.

Boat Builders
(See Launches and Yachts)

Boat Davits
(See Davits).

Boat Design Patents
Hullfin Boat Co., Inc.

Boat Design Licensees.
Hullfin Boat Co., Inc.

Boat Fittings
Sands, A. B., & Son, Co.
Tiebout, W. & J.

Boats
(See Life Boats; also Launches and Yachts)

Boilers
Amer. Spiral Pipe Works.
Babcock & Wilcox Co.
Bath Iron Works.
Bethlehem Shipbuilding Corp.
Charleston Dry Dock & Machine Co.
Federal Shipbuilding Co.
Foster Marine Boiler Corp.
Johnson Iron Works, Dry Dock & S. B. Co., Inc.
Hyde Windlass Co.
Kearfott Engineering Co.
Lake Erie Boiler Works.
New York Engineering Co.
Tickle Engineering Works, Arthur.
Vulcan Iron Works, Inc.
Ward, Charles, Eng. Works.

Boiler Coverings
(See Non-Conducting Coverings)

Boiler Feeders
(See Feed-water Regulators)

Boiler Feed Pumps
(See Pumps)
Alberger Pump & Condenser Co.
Davidson Co., M. T.
De Laval Steam Turbine Co.
Ingersoll-Rand Co.
Kerr Turbine Co.
Northern Fire Apparatus Co.
Warren Steam Pump Co.
Worthington Pump & Machinery Corp.

Boiler Flue Cleaners
Diamond Power Specialty Co., The
McClelland & Co., Ltd., M. E.

Boiler Gauge Glasses
(See Gauge Glasses)

Boiler Makers' Test Pumps
(See Test Pumps)

Boiler Nozzles, Welded Steel
Amer. Spiral Pipe Works
Continental Iron Works, The

Boiler Plates
(See Steel Plates)

Boiler Rivets
(See Rivets)

Boiler Riveters
(See Power Riveters)

Boiler Room Fittings
Crane Co., The
Jerguson Gage & Valve Co.
Kearfott Engineering Co.
Lunkenheimer Co., The
Powell Co., The William
Row & Davis, Engineers, Inc.

Boiler Staybolts
(See Staybolts)

Boiler, Steam and Water Drums, Welded
Continental Iron Works, The

Boiler Tube Cleaners
Roto Co., The

Boiler Tubes
American Spiral Pipe Works.
Federal Shipbuilding Co.
Kearfott Engineering Co.
National Tube Co.
Parkesburg Iron Co.

Books—Shipbuilding
Simmons-Boardman Pub. Co.

Booms—Tubular Steel
National Tube Co.

Boring Bars
(See Cylinder Boring Bars)

Boring Machines—Metal Working
Ingersoll-Rand Co.

Boring Machines—Wood
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co.
Ingersoll-Rand Co.

Brazing Materials.
Smooth-On Mfg. Co.

Brass and Copper
American Brass Co.
Chase Metal Works
Chase Rolling Mill Co.
Sands, A. B., & Son Co.
Scovill Mfg. Co.

Brass Castings
(See Castings—Brass)

Brass Fittings
American Brass Co.
Chase Rolling Mill Co.
Crane Company, The
Lunkenheimer Co., The
Powell Co., The William
Sands, A. B. & Sons Co.
Scovill Mfg. Co.
Tiebout, W. & J.

Brick
(See Fire Brick)

Bridge Control
Westinghouse Electric & Mfg. Co.

Bridge Walls
(See Furnace Bridge Walls)

Brokers
(See Ship Brokers)

Bronze
American Brass Co.
American Manganese Bronze Co.
Chase Metal Works
Chase Rolling Mill Co.
Columbian Bronze Corp.
Crane Co.
Lunkenheimer Co.
Powell Co., The William
Scovill Mfg. Co.

Bulkheads, Plymetl.
Haskelite Mfg. Corp.

Burners, Fuel Oil
(See Fuel Oil Burners)

Bushings
Crane Co., The
Lunkenheimer Co., The

By-Pass Valves
Crane Co., The
Griscom-Russell Co.
Lunkenheimer Co., The
Powell Co., The William
Pratt & Cady Co.

Cables
(See Chain; also Rope)
American Brass Co.

Cableways
(See Marine Cableways)

Caliper Gauges
Williams & Co., J. H.

Calking Machinery
Ingersoll-Rand Co.

Capstans
(Steam, Electric, Hand)
American Engineering Co.
Bethlehem Shipbldg. Corp.
Hadfield-Penfield Steel Co.
Hyde Windlass Co.

Carbon Dioxide Valves and Fittings
Brunswick Refrigerating Co.
Frick Co.
York Manufacturing Co.

Carbon Dioxide Machine
Brunswick Refrigerating Co.
Frick Co.
York Manufacturing Co.

Car Dumpers
McMyler Interstate Co.

Car Floats
American Bridge Co.

Cargo Hoists
(See Hoisting Engines)

Cargo Lights
General Electric Co.

Cargo Pumps
Northern Fire Apparatus Co.

Cargo Winches
(See Winches)

Castings—Aluminum
Griscom-Russell Co.
Hyde Windlass Co.
Lunkenheimer Co., The
Powell Co., The William
Sands, A. B., & Son Co.
Scovill Mfg. Co.

Castings—Brass
Charleston Dry Dock & Machine Co.
Crane Co.
Griscom-Russell Co.
Hyde Windlass Co.
Lunkenheimer Co., The
Powell Co., The William
Sands, A. B., & Son Co.
Scovill Mfg. Co.
Tiebout, W. & J.

Casting—Bronze
American Manganese Bronze Co.
American Steel Foundries
Charleston Dry Dock & Machine Co.
Chase Metal Works
Chase Rolling Mill Co.
Columbian Bronze Co.
Crane Co., The
Ferguson-Herbert Corp'n
Lunkenheimer Co., The
Powell Co., The William
Sands, A. B., & Son Co.
Scovill Mfg. Co.
Tiebout, W. & J.

Castings—Brass and Bronze
Bath Iron Works

Castings—Gray Iron
Ferguson-Herbert Corpn.

Castings—Steel
American Steel Foundries
Bethlehem Shipbldg. Corp.
Chase Metal Works
Chase Rolling Mill Co.
Crane Co., The
Griscom-Russell Co.
Hyde Windlass Co.
Lunkenheimer Co., The
Sands, A. B., & Son Co.

Ceilings
(Cabin)
Marine Decking & Supply Co.

Centrifugal Oil Purifiers
De Laval Separator Co.

Centrifugal Pumps
Alberger Pump & Condenser Co.
Ingersoll-Rand Co.
Kearfott Engineering Co.
Kerr Turbine Co.
Westinghouse Electric & Mfg. Co.
Wheeler Manufacturing Co.
Worthington Pump & Machinery Corp.

Chain
National Malleable Castings Co., The
Kearfott Engineering Co.

Chain Hoists and Blocks
Union Hardware Co.
Wright Mfg. Co.

Cham Pipe Wrenches
American Engineering Co.
Williams Co., J. H.

Chain Stoppers
American Engineering Co.

Chain Valve Wheels
Lunkenheimer Co., The
Powell Co., The William

Charcoal Iron Boiler Tubes
Kearfott Engineering Co.
Parkesburg Iron Co.

Check Valves—Brass and Iron
Crane Co., The
Lunkenheimer Co., The
Powell Co., The William
Pratt & Cady Co., Inc.
Sands & Son Co., A. B.

Chemicals
(See Boiler Compounds)

Chipping Hammers
(See Pneumatic Tools)

Chisel Blanks
Cleveland Pneumatic Tool Co., The
Ingersoll-Rand Co.

Chocks
American Engineering Co.

Chock Fittings
Steward Davit and Equip. Corp.

Chucks
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Circular Shears
The Quickwork Co.

Circulating Pumps
Alberger Pump & Condenser Co.
Davidson Company, M. T.
De Laval Steam Turbine Co.
Ingersoll-Rand Co.
Warren Steam Pump Co.
Westinghouse Electric & Mfg. Co.
Wheeler Mfg. Co., C. H.
Worthington Pump & Machinery Corp.

Circulators
(See Boiler Circulators)

Clamps—Machinists and Tool Makers
Williams & Co., J. H.

Cleaners, Boiler Flue
McClelland, N. E.

Clocks
McNab Co., The

Coal-Handling Machinery
Lidgerwood Mfg. Co.
McMyler Interstate Co.
Shepard Electric Crane & Hoist Co.

Coatings
(See Anti-Rust Coatings)

Cocks
(See Gauge Cocks)

Combined Air and Circulating Pumps
Wheeler Mfg. Co.

Companion Flanges
Crane Co., The
Lunkenheimer Co., The
Powell Co., The William

Compositions
(See Ship's Compositions)

Compounds
(See Boiler Compounds)
(See Rust Cutting and Removing Fluid)

Compression Riveters
(See Power Riveters)

Condensers
Alberger Pump & Condenser Co.
American Engineering Co.
Bath Iron Works
Davidson Co., M. T.
Griscom-Russell Co.
Ingersoll-Rand Co.
Kearfott Engineering Co.
Row & Davis, Engineers, Inc.
Warren Steam Pump Co.
Westinghouse Electric & Mfg. Co.
Wheeler Mfg. Co., C. H.
Worthington Pump & Machinery Corp.

Condenser Tubes
American Brass Co.
Chase Metal Works
Chase Rolling Mill Co.
Kearfott Engineering Co.
Scovill Mfg. Co.

Connecting Rods
Williams & Co., J. H.

Consulting Engineers
(See Engineers, Consulting)

Conveying Machinery
Lidgerwood Mfg. Co.
McMyler Interstate Co.

Conveyors (Coal)
(See Conveying Machinery)

CO² Ice Machines
(See Conveying Dioxide Machines)

Coolers—Oil Coppers
(See Oil Coolers)

Copper
(See Brass and Copper)

Copper Tubes, Rods, Wires
Chase Metal Works
Chase Rolling Mill Co.
Scovill Mfg. Co.

Cordage
(Also see Rope and Wire Rope; also Twine)
Columbian Rope Co.
Griscom-Russell Co.
Plymouth Cordage Co.

Corrugated Furnaces
Continental Iron Works, The

Couplings
(See Hose Couplings)

Coverings—Non-Conducting
(See Non-conducting Coverings)

Coverings, Composition Floor,
Coffey Eng. Corp., The J. A.
Marine Decking.

Cranes
(Also see Floating Cranes and Shipyards Whirlers)
American Engineering Co.
McMyler Interstate Co.
Shepard Electric Crane & Hoist Co.

Crank Shafts
Williams & Co., J. H.

Curtains and Fixtures.
Pantasote Co., The

Cutting and Welding
(See Welding)

Cyclopedias—Shipbuilding
Simmons-Boardman Pub. Co.

Cylinder Boring Bars
Williams & Co., J. H.

Cylinder Relief Valves
(See Valves)

Cylinders for Compressed Air, Gas, Etc.
Continental Iron Works, The
National Tube Co.

Davits
Stewart Davit & Equip. Corp.

Deck Fittings
Steward Davit & Equip. Corp.

Deck Plates
Sands & Son, A. B.

Deck Pumps
Sands & Son Co., A. B.
Warren Steam Pump Co.

Decking
Beaver Tile Co.
Briggs Bituminous Composition Co.
J. A. Coffey Eng. Corp.
Marine Decking & Supply Co.

Derricks
Lidgerwood Mfg. Co.
McMyler Interstate Co.

Derrick Cars
McMyler Interstate Co.

Derrick Irons
Lidgerwood Mfg. Co.

Detaching Gear (Boat)
Steward Davit & Equip. Corp.

Detectors, Elec. Salinity
Babcock & Wilcox Co., The

Diaphragm Pumps
Hyde Windlass Co.

Dies
Brubaker & Bros., W. L.

Diesel Engines
(Also see Engines, Oil)
American-Krupp System Diesel Engine Co.
Burmeister & Wain, Ltd.
Busch-Sulzer Bros. Diesel Engine Co.
Hadfield-Penfield Steel Co.
Kearfott Engineering Co.
McIntosh & Seymour Corp.
Winton Engine Works
Worthington Pump & Machinery Corp.

Direct-Connected Sets
(See Electrical Plants)

Disengaging Gears
Steward Davit & Equip. Corp.

Distillers
(See Evaporators)

Draft Gages
Pneumercator Co.

Drain Valves
(See Valves)

Drawing Materials
(Board, Cloth, Paper, Ink, Etc.)

Dredging Machinery
American Eng'neering Co.
Lidgerwood Mfg. Co.
McClelland, N. E.
McMyler Interstate Co.
McClelland & Co., Ltd., M. E.

Dredging Pumps
Worthington Pump & Machinery Corp.

Drills, Electric
(See Electric Drills)

Drills, Pneumatic
(See Pneumatic Tools)

Drills, Portable
(See Portable Drills)

Drills, Wall Radial
(See Radial Drills)

Drop Forgings
(Eye Bolts, Wrenches, Etc.)
Williams & Co., J. H.

Drop Hammers
Chambersburg Engineering Co.

Dry Dock Pumps
Alberger Pump & Condenser Co.
Worthington Pump & Machinery Corp.

Dry Docks
(Manufacturer and Marine Railways)
Bethlehem Shipbldg. Corp.
Crandall Engineering Co.
Federal Shipbuilding Co.

Dry Docks and Marine Railways
Bethlehem Shipbuilding Corp., Ltd.
Charleston Dry Dock & Machine Co.
Federal Shipbuilding Co.
Merchant Shipbuilding Corp.
Pensacola Shipbuilding Co.
Sun Shipbuilding Co.
Todd Shipyards Corp.

Dynamometers
Wheeler Mfg. Co., C. H.

Dynamos
(See Electric Plants)

Economizer, Fuel
(See Fuel Economizer)

Ejectors
Lunkenheimer Co.

Electric Cutouts
General Electric Co.

Electric Cranes
(See Electric Hoists)

Electric Drills and Grinders
Chicago Pneumatic Tool Co.
General Electric Co.

Electric Driven Pumps
Alberger Pump & Condenser Co.
Ingersoll-Rand Co.

Electric Freight Trucks
(See Freight-Handling)

Electric Fire Alarm Systems

Electric Heaters
General Electric Co.

Electric Hoists
American Engineering Co.
Chicago Pneumatic Tool Co.
General Electric Co.
Hyde Windlass Co.
Lidgerwood Mfg. Co.
Shepard Elec. Crane & Hoist Co.

Electric Lighting
General Electric Co.

Electric Meters
(See Meters, Electric)

Electric Plants
General Electric Co.
Kerr Turbine Co.
Westinghouse Electric & Mfg. Co.

Electric Pumps
(See Electric Drives Pumps)

Electric Welding
(See Welding, Electric)

Electrical Appliances, Installations, Fittings and Supplies

Electrical Instruments
General Electric Co.

Elevators, Air and Hydraulic
(Also see Portable Elevators)

Engine Generating Sets.
General Electric Co.

Engine Oil
(See Lubricants)

Engine Packing
(See Packing)

Engine Room Counters
(See Revolution Counters)

Engineers, Consulting—Marine
American Engineering Co.
Bogert, J. L.
Bonner, William T.
Chapman & Fisher
Christensen & Snethlage
Crandall Engineering Co.
Donnelly, W. T.
Ferris, Theodore
Griffin & Cathcart
Haag, A. H.
Haight, Robert S.
Matthews, John B.
McClelland & Co., N. E., Ltd.
Rossell & Thayer
Row & Davis, Engineers, Inc.
Sharp, Geo. G.
Tickle Engineering Works, Arthur
Watts, J. Murray
Whittelsey & Whittelsey

Engines for Auxiliaries
De Laval Steam Turbine Co.
Hyde Windlass Co.
Kearfott Engineering Co.
Kerr Turbine Co.
McIntosh & Seymour Corp.
Westinghouse Electric & Mfg. Co.

Engines, Gasoline
(See Gasoline Engines)

Engines, Hoisting
(See Hoisting Engines)

Engines, Kerosene
(See Kerosene Engines)

Engines, Oil
(Also see Diesel Engines)
American-Krupp System Diesel Engine Co.
Burmeister & Wain, Ltd.
Busch-Sulzer Bros. Diesel Engine Co.
Chicago Pneumatic Tool Co.
Hadfield-Penfield Steel Co.
Ingersoll-Rand Co.
Johnson Iron Works, Ltd.
Kearfott Engineering Co.
McIntosh & Seymour Corp.
New London Ship & Engine Co.
Standard Motor Construction Co.
Winton Engine Co.
Worthington Pump & Machinery Corp.

Engines, Propelling
Bath Iron Works
Bethlehem Shipbuilding Corp.
Hadfield-Penfield Steel Co.
Ingersoll-Rand Co.
Kearfott Engineering Co.
McIntosh & Seymour Corp.
Standard Motor Construction Co.
Trout Co., H. G.
Ward, Chas., Engineering Works
Winton Engine Co.
Worthington Pump & Machinery Corp.

Engines, Pumping
Alberger Pump & Condenser Co.
Davidson Co., M. T.
Exeter Machine Works.
Griscom-Russell Co.
Kearfott Engineering Co.
Row & Davis, Engineers, Inc.
Worthington Pump & Machinery Corp.

Engine-Room Clocks
(See Clocks)

Engine-Room Supplies
(See Steam Specialties)

Evaporators
American Engineering Co.
Davidson Co., M. T.
Griscom-Russell Co.
Kearfott Engineering Co.
Row & Davis, Engineers, Inc.

Exhaust Fans
(See Blowers)

Expanders
(See Boiler Flue Expanders and Pipe Expanding and Flanging Machines)

Expansion Joints
Alberger Pump & Condenser Co.
Crane Co., The
Griscom-Russell Co.
Lunkenheimer Co.
Powell Co., The William

Eye Bolts
Williams & Co., J. H.

Fans, Bracket
General Electric Co.

Feed Water Heaters
Alberger Pump & Condenser Co.
Griscom-Russell Co.
Kearfott Engineering Co.
Pratt & Cady Co., Inc.
Row & Davis, Engineers, Inc.
Worthington Pump & Machinery Corp.

Feed Water Regulators
Jerguson Gage & Valve Co.
Kearfott Engineering Co.

Fences
(See Wire Fences)

Ferrules—Condenser Tube
(See Condenser Tube Ferrules)

Filters, Feed Water
Griscom-Russell Co.

Filters—Marine Oil
Griscom-Russell Co.
Kearfott Engineering Co.
Row & Davis, Engineers, Inc.

Fire Bricks
Jointless Fire Brick Co.

Fire Hose
(See Hose)

Fireproof Lumber
(See Lumber, Fireproof)

Fire Pumps
Alberger Pump & Condenser Co.
Warren Steam Pump Co.
Worthington Pump & Machinery Corp.

Fittings, Cast Steel
Reading Valve & Fittings Co.

Fixtures, Plumbing
Sands & Son Co., A. B.

Flanges
Amer. Spiral Pipe Works
Crane Co., The
Lunkenheimer Co., The

Flanging Machines
Williams Co., J. H.

Floating Cranes
(Also see Cranes)
McMyler-Interstate Co.

Float Valves
Crane Co., The
Lunkenheimer Co., The

Floating Dry Docks
(See Dry Docks)

Floor Plates
Crane Co., The

Flue Cleaners
(See Boiler Flue Cleaners)

Flue Cutters
(See Boiler Flue Cutters)

Forced Draft
(See also Blowers)
De Laval Steam Turbine Co.
General Electric Co.
Kearfott Engineering Co.
Kerr Turbine Co.

Forges
C. C. Bradley & Son

Forgings, Bronze
Hyde Windlass Co.
Tickle Engineering Works, Arthur

Forgings—Drop
(See Drop Forgings)

Forgings, Iron and Steel
(Also see Drop Forgings)
Charleston Dry Dock & Machine Co.

Freight-Handling Equipment
General Electric Co.
Lidgerwood Mfg. Co.
McMyler Interstate Co.
Shepard Electric Crane & Hoist Co.

Fuel Economizer
Griscom-Russell Co.

Fuel Oil Burners
Bethlehem Shipbuilding Corp., Ltd.
Babcock & Wilcox Co.
Peabody Engineering Co.
Schulte & Koerting Co.
White Fuel Oil Engineering Corp.

Fuel Oil Heaters
Alberger Pump & Condenser Co.
Griscom-Russell Co.

Fuel Oil Pumps
Davidson Co., M. T.
Warren Steam Pump Co.

Furnace Bridge Walls
Egan Ref. Eng. Co., Inc., T. G.
Ferguson-Herbert Corp'n

Furnace Fronts
Continental Iron Works, The

Furnaces
(Also see Oil Furnaces)
Amer. Spiral Pipe Works
Continental Iron Works, The

Fusible Plugs
Crane Co., The
Griscom-Russell Co.
Lunkenheimer Co., the

Galley Pumps
Sands & Son, Co., A. B.

Galleys
(See Ranges)

Galvanized Material
Sands, A. B., & Son Co.
Tiebout, W. & J.

Gas Engine Specialties
Crane Co., The
Lunkenheimer Co., The
Powell Co., The William

Gaskets
(Also see Packing)
Crane Co., The
Goetze Gasket & Packing Co.
Griscom-Russell Co.
Mustor Mfg. Co.
Smooth-On Mfg. Co.

Gasoline Engines
Standard Motor Construction Co.
Winton Engine Co.

Gasoline Pumps
Sands & Son Co., A. B.
Worthington Pump & Machinery Corp.

Gate Valves — Brass and Iron
Crane Co., The
Lunkenheimer Co., The
Pratt & Cady Co., Inc.
Powell Co., The William
Reading Valve & Fittings Co.

Gate Valves for Tank Steamers
Pratt & Cady Co., Inc.

Gage, Air Pressure
Peabody Engineering Co.

Gage Cocks
Jerguson Gage & Valve Co.
Lunkenheimer Co., The
Powell Co., The William
Sands & Son Co., A. B.

Gage Glasses
Crane Co, The
Jerguson Gage & Valve Co.
Lunkenheimer Co., The
Powell Co., The William

Gages
(See Draft Gauges; also Tank Gauges)

Gages—Manufacturers'
(Also see Steam Gauges)

Gages, Steam, Pressure
Ashton Valve Co., The

Gears
De Laval Steam Turbine Co.
Falk Corp., The
Kerr Turbine Co.
Westinghouse Electric & Mfg. Co.

General Welding and Cutting Equipment
(See Welding & Cutting Apparatus and Supplies)

Generating Sets
Engberg's Electric & Mechanical Wks.
General Electric Co.
Kerr Turbine Co.
Westinghouse Electric & Mfg. Co.
Worthington Pump & Machinery Corp.

Generators, Elec.
Diehl Mfg. Co.
General Electric Co.
Engberg's Electric & Mechanical Wks.

Globe Valves—Brass and Iron
Crane Co., The
Lunkenheimer Co., The
Powell Co., The William
Pratt & Cady Co., Inc.

Governor Valves
Atlas Valve Co.
Crane Co., The
Lunkenheimer Co., The

Governors, Pump
Atlas Valve Co.

Grate Bars
Ferguson-Herbert Corp'n

Grease
(See Lubricants)

Grease Cups
Crane Co., The
Lunkenheimer Co., The
Powell Co., The William

Grease Extractors
Griscom-Russell Co.
Row & Davis, Engineers, Inc.

Grinders—Electric and Pneumatic
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co., The

Gypseys
American Engineering Co.
Hyde Windlass Co.
Lidgerwood Mfg. Co.

Hammers
Bradley & Son, C. C.
Quickwork Co.

Hammers, Pneumatic
(See Pneumatic Tools)

Hammocks
(See Couch Hammocks)

Handles (Crank, Balance, Machine)
Williams & Co., J. H.

Hardware
(See Marine Hardware)

Hardwood
(See Lumber)

Hawse Pipes
Ferguson-Herbert Corp'n

Hawsers—Manila
(Also see Rope and Wire Rope)
Columbian Rope Co.
Plymouth Cordage Co.

Heaters
(Bath, Lavatory, Shower)
Alberger Pump & Condenser Co.
Griscom-Russell Co.
Kearfott Engineering Co.
Pratt & Cady Co., Inc.
Sands & Son Co., A. B.

Heaters, F. O.
Griscom-Russell Co.

Heating and Ventilating Equipment.

Hemp
(See Twine)

Hoist Hooks
Williams, J. H., & Co.

Hoisting Engines
American Engineering Co.
Hadfield-Penfield Steel Co.
Hyde Windlass Co.
Lidgerwood Mfg. Co.

Hoisting and Transmission Rope
(See Rope)

Hoists, Chain
(See Chain Hoists)

Hoists, Electric
(See Electric Hoists)

Holders-On
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Horizontal Punches
Cleveland Punch & Shear Works Co.

Hose
(Also see Air Hose)
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co., The
Ingersoll-Rand Co.
Mustor Mfg. Co.

Hose Coupling
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co.
Ingersoll-Rand Co.
McClelland & Co., Ltd., M. E.
Mustor Mfg. Co.

Humidifiers
Griscom-Russell Co.

Hydraulic Fittings
Crane Co., The
Lunkenheimer Co.
Powell Co., The William
Reading Valve & Fittings Co.

Hydraulic Presses and Other Machinery
Warren Steam Pump Co.

Hydrometers
Taylor Instruments Co.

Hygrodeiks
Taylor Instruments Co.

Hydrostats
Atlas Valve Co.

Ice Machines
(See Refrigerating Machinery)

Indicator Connections
Lunkenheimer Co.
Powell Co., The William

Indicators
(Steam and Gas Engine)
Lunkenheimer Co., The
Powell Co., The William

Injectors
Lunkenheimer Co., The
Powell Co., The William

Interlocking Rubber Tiling
Griscom-Russell Co.
Mustor Mfg. Co.

Iron Pipe
(See Pipe)

Jacks—Steamboat Ratchet (Pulling)
Griscom-Russell Co.

Journal Bearings
(See Thrust Bearings)

Jute
Columbian Rope Co.

Kerosene Engines
Standard Motor Construction Co.

Lamps, Signals and Fixtures
General Electric Co.
Sands, A. B. & Son Co.
Westinghouse Electric & Mfg. Co.

Lathe Dogs
Williams & Co., J. H.

Launches and Yachts
(See shipbuilders)

Lavatories
(Stateroom)
Crane Co., The
Sands, A. B., & Son Co.

Lavatory and Bath Heaters
Griscom-Russell Co.
Sands, A. B., & Son Co.

Lead, Blue
Eagle-Pitcher Lead Co., The

Licensees, Boat Design.
Hullfin Boat Co., Inc.

Life Boats and Rafts
American Bolsa Co.
Steward Davit & Equip. Corp.

Life-Saving Devices
Steward Davit & Equip. Corp.

Lighting Sets
(See Electric Plants)

Lights, Electric
(See Electric Lights)

Lines—Towing, Buoy
(See Rope)

Loading and Unloading Equipment
(See Freight-Handling Equipment)

Locks and Latches
(See Ship Locks and Latches)

Locomotive Cranes
(See Cranes)

Log Registers
Steward Davit & Equip. Corp.

Lubricating Oil Pumps
Warren Steam Pump Co.

Lubricators
Crane Co.
Griscom-Russell Co.
Lunkenheimer Co.
Powell Co., The William

Lumber
Orr Co., John C.
McKenna, Inc., J. F.

Machine Tools
Cleveland Pneumatic Tool Co.

Machines, Crimping
Quickwork Co., The

Machinists' Tools
Williams & Co., J. H.

Manganese Bronze Castings
American Manganese Bronze Co.
Columbian Bronze Corp.
Griscom-Russell Co.
Hyde Windlass Co.
Lunkenheimer Co.
Powell Co., The William

Malleable and Steel Castings
Crane Co.

Manila and Sisal Rope
(See Rope)

Manifolds
Cleveland Pneumatic Tool Co.

Manufacturing Plants
(See Builders)

Marine Boiler Heads
(See Boiler Heads)

Marine Cableways
Lidgerwood Mfg. Co.

Marine Coatings
(See Anti-Rust Coastings)

Marine Decking
(See Decking)

Marine Electrical Equipment
(See Electrical Fittings and Supplies)

Marine Engines
(See Engines, Propelling)

Marine Engineers
(See Engineers, Consulting)

Marine Forgings
(See Forgings)

Marine Glue
Briggs Bituminous Composition Co.

Marine Hardware
Sands & Son Co., A. B.
Tiebout, W. & J.

Marine Heaters
(See Heaters)

Marine Paint
(Also see Paint)
Briggs Bituminous Composition Co., Inc.
Red Hand Composition Co., Inc.
Wailes Dove - Hermiston Corp.

Marine Plumbing
Crane Co., The
Sands & Son Co., A. B.

Marine Railway Builders
Crandall Engineering Co.

Marine Railways
(See Dry Docks)

Marine Ranges
(See Ranges)

Marine Refrigeration
(See Refrigerating Machinery)

Marine Repairs
(See Shipbuilders)

Marine Shafting
(See Shafting)

Marine Specialties
(See Steam Specialties)

Marine Superheaters
Babcock & Wilcox Co.
Power Specialty Co.
Superheater Co., The

Marine Supplies
Tiebout, W. & J.

Marine Wiring Devices
General Electric Co.

Masts, Tubular Steel
National Tube Co.

Mechanical Telegraphs
Radio Corporation of America

Metallic Packing
(Also see Packing)
Goetze Gasket & Packing Co.

Meters, Electric
General Electric Co.

Mineral Wool
(See Non-Conducting Covering)

Mooring Engines
American Engineering Co.
Hyde Windlass Co.
Lidgerwood Mfg. Co.

Motor Boats
(See Launches and Yachts)

Motor Boat Supplies
Tiebout, W. & J.

Motors, Electric
General Electric Co.

Motors, Gasoline
(See Gasoline Engines)

Multiwhirl Oil Coolers
Griscom-Russell Co.

Naval Architects
Bogert, John L.
Chapman & Fisher
Christensen & Snethlage
Donnelly, William T.
Ferris, Theodore
Griffin & Cathcart
Haag, A. H.
Haight, Robert S.
McClelland, N. E., & Co., Ltd.
Matthews, John B.
Moon, C. P.
Rossell & Thayer
Sharp, Geo. G.
Watts, J. Murray
Whittelsey & Whittelsey

Needle Valves
(See Valves)

Nipples
Crane Co., The
Lunkenheimer Co., The

Non-Toppling Blocks
Steward Davit & Equipment Corp.

Nozzles
(See Hose Nozzles)

Oakum
Stratford Oakum Co., Geo.

Oil
(See Lubricants)

Oils Burners, Fuel
(See Fuel Oil Burners)

Oil Burning Equipment
Bethlehem Shipbldg. Corp.
White Fuel Oil Engineering Corp.

Oil Coolers
Alberger Pump & Condenser Co.
Griscom-Russell Co.

Oil Cups
Crane Co.
Griscom-Russell Co.
Lunkenheimer Co., The
Powell Co., The William

Oil Engines
(See Engines, Oil)

Oil Fuel
Standard Oil Co. (New Jersey)

Oil Fuel Apparatus
(See Oil-Burning Equipment)

Oil Gages
Crane Co.
Lunkenheimer Co., The
Powell Co., The William

Oil Heaters and Coolers
Alberger Pump & Condenser Co.
Griscom-Russell Co.
Row & Davis, Engineers, Inc.

Oil Pumps
Davidson, M. T., Co.
Ingersoll-Rand Co.
Lunkenheimer Co., The
Powell Co., The William
National Transit Pump & Machine Co.
Sands, A. B., & Son, Co.
Warren Steam Pump Wks.
Worthington Pump & Machinery Corp.

Oil Purifiers
De Laval Separator Co.
Griscom-Russell Co.

Oil Tankers
(See Tank Ships)

Oiling Systems
(Also see Lubricants)
Lunkenheimer Co., The
Powell Co., The William

Ore-Handling Machinery
(See Coal-Handling Machinery)

Oxy-Acetylene Welding and Cutting
Prest-O-Lite Co., Inc.
Vulcan Iron Works, Inc.

Oxygen
Linde Air Products Co.
Prest-O-Lite Co.

Packing
(Also see Metallic Packing and Ammonia Packing)
Goetz Packing Co.
Mustor Mfg. Co.

Packing, Asbestos
Crane Co.
McClelland, N. E.
Mustor Mfg. Co.

Paint
Briggs Bituminous Composition Co.
Federal Composition & Paint Co.
Marine Decking & Supply Co.
Red Hand Composition Co., Inc.
Wailes Dove-Hermiston Corp.

Paint Spraying Equipment
(See Pneumatic Paint Spraying Equipment)

Panelling
(Marine Fireproof)
Marine Decking & Supply Co.

Panels, Bulkhead
Haskelite Mfg. Corp.

Partitions
(Marine Fireproof)
Marine Decking & Supply Co.

Patents, Boat Design.
Hullfin Boat Co., Inc.

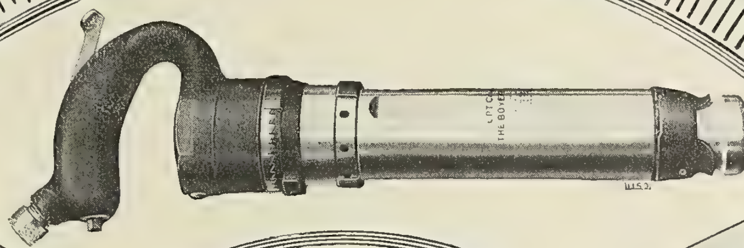
Pencils
(See Drawing Pencils)

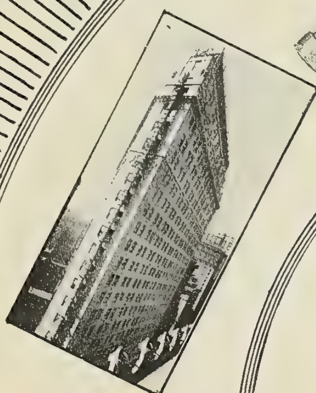
Phosphor Bronze Castings
American Manganese Bronze Co.
Columbian Bronz Corp.
Griscom-Russell Co.
Hyde Windlass Co.
Lunkenheimer Co., The

Pile Drivers
Lidgerwood Mfg. Co.
McMyler-Interstate Co.

Pipe
American Brass Co.
Chase Metal Works.
National Tube Co.
Scovill Mfg. Co.

BOYER-SKYSCRAPER BUILDER





Above—Munson Building, N.Y.C. Contains 71,000 Boyer-driven rivets.

Above—Bush Building, N.Y.C. Contains 65,000 Boyer-driven rivets.

THROUGHOUT the notable career of Post & McCord, structural steel specialists, New York, the Boyer Riveting Hammer has built a lasting reputation with them and their riveters.

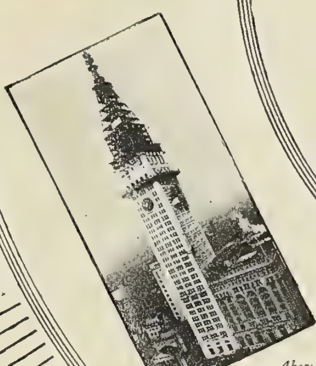
Illustrated are but a few of the many skyscrapers Post & McCord have built with the aid of the Boyer.

With its speed of 850 to 2100 blows per minute, great driving power, ease of control and operating economy—the Boyer drives rivets, *all perfect, at least cost per rivet driven.*

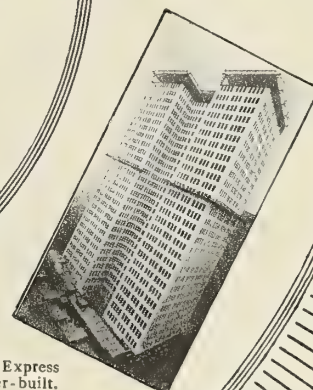
What is your per-rivet-driven cost? Lower it by making Boyers your standard as have Post & McCord.

Ask for Bulletin 810.

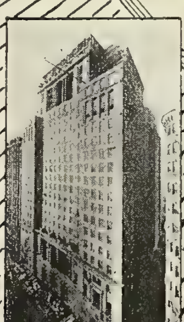
Chicago Pneumatic Tool Co.
6 East 44th Street, New York
Sales and Service Branches All Over the World



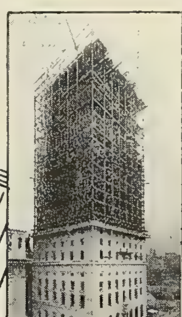
Above at left — Metropolitan Building, N.Y.C. Boyer-built.



Above at right—Adams Express Building, N.Y. C. Boyer-built.



At left—Cunard Building, N.Y.C. Contains 157,000 Boyer-driven rivets.



At left—Yale Club Contains 60,000 Boyer-driven rivets.

At right—Astor Trust Building, N.Y.C. Boyer-built.

At right—Bankers Trust Building, N.Y.C. Contains 102,000 Boyer-driven rivets.

BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · · VACUUM PUMPS · · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES ROCK DRILLS · · COAL DRILLS

P-164

CHICAGO CHICAGO CP PNEUMATIC **PNEUMATIC**

Depend upon that Name

Pipe Covering
(See Non-Conducting Covering)

Pipe Fittings
Atlas Valve Co.

Pipe Flanges
(See Flanges)

Pipe, Steel
National Tube

Pipe Unions
Atlas Valve Co.
Crane Co.
Lunkenheimer Co., The
Powell Co., The William

Pipe Wrenches
Williams & Co., J. H.

Piston Rings
(See Packings)

Planers
(Metal Working)
Cleveland Pneumatic Tool Co.

Plastic Fire Bricks
Jointless Fire Brick Co.

Plate-Bending Rolls
(See Rolls, Bending & Straightening)

Plate Castors
(See Castors)

Plate Shears
The Quickwork Co.

Plates
(See Steel Plates and Shapes)

Plumbers' Tools
Williams & Co., J. H.

Plumbing
(See Marine Plumbing)

Pneumatic Drills
(See Pneumatic Tools)

Pneumatic Hammers
(See Pneumatic Tools)

Pneumatic Hose
(See Air Hose)
Sands, A. B., & Son, Co.

Pneumatic Riveters
Ingersoll-Rand Co.

Pneumatic Separators
Griscom-Russell Co.

Pneumatic Tools
Cleveland Pneumatic Tool Co.
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Pop Safety Valves
Crane Co.
Lunkenheimer Co., The
Powell Co., The William

Poppet Valves
(See Valves)

Portable Drills
General Electric Co.

Portable Elevators
(For Handling Bulk Materials)

Power Hammers
The Quickwork Co.

Power Riveters
Ingersoll-Rand Co.

Power Shears
Quickwork Co.

Presses
(See Hydraulic Presses)

Pressure Regulators
Atlas Valve Co.
Crane Co.
Lunkenheimer Co., The
Powell Co., The William

Professional Cards
Aero Alarm Co.
Ansell & Bailey
Bogert, John L.
Bonner, William T.
Chapman & Fisher
Christensen & Snethlage
Ferris, Theodore
Griffin & Cathcart
Haag, A. H.
Haight, Robert S
Matthews, John B.
McClelland, N. E., & Co., Ltd.
Pommer, Walter E.
Rossell & Thayer
Sharp, Geo. G.
Watts, J. Murray
Whittelsey & Whittelsey

Projectors
(See Searchlights)

Propeller Shafts
(See Shafting)

Propeller Wheels
American Manganese Bronze Co.
Bethlehem Shipbldg. Corp.
Columbian Bronze Corp.
Donnelly, Wm. T.
Ferguson-Herbert Corp'n
Hyde Windlass Co.
Kearfott Engineering Co.
Trout Co., H. G.

Pumping Machinery
(See Engines, Pumping)

Pumps
Alberger Pump & Condenser Co.
Bethlehem Shipbldg. Corp.
Davidson Co., M. T.
De Laval Steam Turbine Co.
Exeter Machine Works.
Griscom-Russell Co.
Hyde Windlass Co.
Ingersoll-Rand Co.
Kerr Turbine Co.
National Transit Pump & Machine Co.
Row & Davis, Engineers, Inc.
Sands & Son, Co., A. B.
Warren Steam Pump Co.
Wheeler Mfg. Co., C. H.
Westinghouse Electric & Mfg. Co.
Worthington Pump & Machinery Corp.

Pump, Elec.
Exeter Machine Works.
General Electric Co.
Northern Fire Apparatus Co.

Punching Machines
(See Power Punches)

Punching and Shearing Machines
(See Power Machines and Shears)

Punch Tables
(See Spacing Tables)

Purifiers, Oil
De Laval Separator Co.

Pyrometers
Superheater Co., The
Taylor Instruments Co.

Quadrant Davits
(See Davits)

Radio Apparatus
Radio Corporation of America.

Rafts
(See Lifeboats and Rafts)

Ranges
Sands, A. B. & Sons Co.
Stamford Foundry Co., The

Ratchet Jacks
(Pulling and Pushing)

Reamers
Brubaker & Bros., W. L.
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co., The

Reclaiming Systems For Oil
De Laval Separator Co.

Reducing Gears
(See Gears)

Reducing Valves
Atlas Valve Co.
Crane Co.
Lunkenheimer Co., The

Reflex Water Gauges
Jerguson Gage & Valve Co.

Refrigerating Machinery
Brunswick Refrigerating Co.
Frick Co.
Westinghouse Electric & Mfg. Co.
York Mfg. Co.

Regulators, Damper
Atlas Valve Co.

Regulators, Temperature and Pressure.
Taylor Instruments Co.

Releasing Gear
Steward Davit & Equip. Corp.

Relief Valves
Atlas Valve Co.
Crane Co.
Lunkenheimer Co., The
Powell Co., The William

Repairs, Marine.
Bethlehem Shipbldg. Corp.
Federal Shipbuilding Co.
Tickle Engineering Works, Arthur.

Rheostats
General Electric Co.

Rigging
(See Rope; also Wire Rope)

River Boats
(See Shipbuilders)

Rivet Busters, Rivet Clamps and Rivet Tongs
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co., The
Ingersoll-Rand Co.

Riveters
(See Pneumatic Riveters and Power Riveters)

Riveting Machines, Hydraulic and Steam Power
(Also see Power Riveters and Pneumatic Riveters)
Chicago Pneumatic Tool Co.

Rods (Brass)
American Brass Co.
Chase Metal Works
Chase Rolling Mill Co.
Scovill Mfg. Co.

Rods, Welding
(See Welding Rods)

Rolling Sheet Metal Machines
The Quickwork Co.

Rope
(Also see Wire Rope)
Columbian Rope Co.
Plymouth Cordage Co.

Rope, Blocks
Union Hardware Co.

Rope Transmission
Columbian Rope Co.

Rotary Blowers
(See Blowers)

Rotary Pumps
Sands, A. B., & Son, Co.

Rotary Shears
Quickwork Co., The

Rowboats
(See Launches and Yachts)

Rubber Goods
(Also see Packing; also see Interlocking Rubber Tiling)

Rubber Tiling
(See Interlocking Rubber Tiling)

Safety Devices
(See Life Saving Devices)

Safety Valves
(See Valves)

Sanitary Fittings
(See Plumbing)

Sanitary Pumps
Davidson Co., M. T.
Sands, A. B., & Son, Co.
Warren Steam Pump Co.

Separators, Oil.
Babcock & Wilcox Co., The

Scuttles
Steward Davit & Equip. Corp.

Seamless Steel Tubes
National Tube Co.

Sentinel Valves
(See Valves)

Shaft Steel
(See Steel Shafting)

Shafting
(Seamless Steel)
Ferguson-Herbert Corp'n
Kearfott Engineering Co.
National Tube Co.

Shafting— Bronze
American Manganese Bronze Co.
Chase Metal Works
Chase Rolling Mill Co.
Scovill Mfg. Co.

Shearing Machines
(See Power Shears)
The Quickwork Co.

Sheet Metal Working Machines
The Quickwork Co.

Sheet Metal Shears
The Quickwork Co.

Sheets, Brass
American Brass Co.
Chase Metal Works.

Shipbuilders and Dry Dock Companies
Bath Iron Works
Bethlehem Shipbuilding Corp.
Charleston Dry Dock & Machine Co.
Cramp & Sons, Wm.
Federal Shipbuilding Co.
Fletcher Co., W. & A.
Johnson Iron Works, Dry Dock & S. B. Co., Inc.
Merchant Shipbuilding Corp.
New London Ship & Engine Co.
New York Shipbuilding Corp.
Pensacola Shipbuilding Co.
Standard Motor Construction Co.
Sun Shipbuilding Co.
Tickle Engineering Works, Arthur
Todd Shipyards Corp.
Vulcan Iron Works, Inc.
Ward, Chas., Engineering Works

Ship Brokers
Bogert, John L.
Ferris, Theodore
Haight, Edward S.
McClelland, N. E., & Co., Inc.
Pommer, Walter E.
Watts, J. Murray

Ship Clocks
(See Clocks).

Ship Compositions
Briggs Bituminous Composition Co.
Red Hand Composition Co., Inc.
Wailes Dove-Hermiston Corp.

Ship Cowls
(See Cowls)

Ship Design Licensees.
Hullfin Boat Co., Inc.

Ship Design Patents
Hullfin Boat Co., Inc.

Ship Fittings, Supplies and Equipment
Griscom-Russell Co.

Ship Glue
(See Marine Glue)

Ship Locks and Lathes
Tiebout, W. & J.

Ship Operators
International Mercantile Marine Co.
United American Line

Ship Plates
(See Steel Plates; also Zinc Ship and Boiler Plates)

Ship Repairs
(See Dry Docks and Marine Railways)

Ship Rivets
(See Rivets)

Ship Stores
(See Chandlery Stores)

Ship Timbers
Orr Co., John C.

Ship Upholstery
Pantasote Co., The

Shipyards
(See Shipbuilders)

Shipyard Cranes
(See Cranes)

Shipyard Whirlers
(See Cranes)

Shop Cranes
(See Cranes)

Skylight Lifting Gear
Tiebout, W. & J.

Sleeves
(See Sockets and Sleeves)

Slitting Machines
The Quickwork Co.

Small Tools
(See Bench Tools)

Southern Pine
(See Lumber)

Special Copper Work
Sands, A. B., & Son

Splitting Shears
The Quickwork Co.

Sprocket Rims
(See Adjustable Sprocket Rims)

Staybolt Taps
(See Taps and Dies)

Steam Engines
(See Engines)

Steam Gages.
Crane Co., The
Lunkenheimer Co.
Powell Co., The William
Taylor Instruments Co.

Steam Hammers
Chambersburg Engineering Co.

Steam Hoists
(See Hoisting Engines)

Steam Hose
Ingersoll-Rand Co.

Steam Pipe Coverings
(See Non-Conducting Coverings)

Steam Pumps
(See Pumps)

Steam Separators
Crane Co.
Griscom-Russell Co.

Steam Specialties
(See Pumps, Valves, Gauges, Lubricators, Etc.)

Steam Superheaters
(See Marine Superheaters)

Steam Traps
Crane Co.
Griscom-Russell Co.
Pratt & Cady Co., Inc.
Sands, A. B., & Son Co.

Steam Turbines
Alberger Pump & Condenser Co.
Bath Iron Works
Bethlehem Shipbuilding Corp.
De Laval Steam Turbine Co.
Fletcher Co., W. & A.
General Electric Co.
Kerr Turbine Co.
Kearfott Engineering Co.
Westinghouse Electric & Mfg. Co.

Steam Turbine Dynamos
De Laval Steam Turbine Co.
General Electric Co.
Kearfott Engineering Co.
Kerr Turbine Co.
Vulcan Iron Works, Inc.
Westinghouse Electric & Mfg. Co.

Steel Castings
(See Castings, Steel)

Steel Fittings
Reading Valve & Fittings Co.

Steel Pipe
Crane Co.
National Tube Co.

Steel Plates
(See Steel Plates and Shapes)

Steel Shafting
(See Shafting)

Steering Engines
American Engineering Co.
Hadfield-Penfield Steel Co.
Hyde Windlass Co.
Kearfott Engineering Co.
Lidgerwood Mfg. Co.

Steering Gears
American Engineering Co.
Bethlehem Shipbldg. Corp.
Hadfield-Penfield Steel Co.
Hyde Windlass Co.
Lidgerwood Mfg. Co.

Steering Wheels
American Engineering Co.
Hadfield-Penfield Steel Co.
Hyde Windlass Co.

Stop Cocks
(See Valves)

Stoves
(See Ranges)

Straightening Rolls
(See Rolls)

Superheaters
(See Marine Superheaters)

Superheater Tubes
National Tube Company

Surface Condensers
Davidson Co., M. T.
Wheeler Mfg. Co., C. H.

Switches and Switchboards
General Electric Co.

Tail Shafts
(See Shafting)

Tanks
(Copper, Galvanized Iron)
Bath Iron Works
Griscom-Russell Co.
Sands, A. B., & Sons Co.

Tank Gauges
Pneumacator Co.

Tank Gauges, Oil Storage
Pneumacator Co.

Tank Ships
Bath Iron Works
Merchant Shipbuilding Corp.

Tank Pumps
Davidson Co., M. T.
Warren Steam Pump Co.

Tanks, Seamless Steel
Continental Iron Works, The
National Tube Co.

Tanks, Welded Steel
Continental Iron Works, The

Taps and Dies
Brubaker, W. L., & Bros.

Telegraph Apparatus and Telegraphs—Mechanical
(See Mechanical Telegraphs)

Telegraph Fittings and Voice Tubes and Fittings
Tiebout, W. & J.

Telemotors—Electric and Hydraulic
American Engineering Co.
Hyde Windlass Co.

Telephones and Telephone Apparatus
(Also see Ship Telephones)
Radio Corp. of America

Telltale Board, Running Light
General Electric Co.

Temperature Regulators
Taylor Instruments Co.

Thermit Welding
Powell Co., The William

Thermometers
Taylor Instruments Co.

Thermostats
Atlas Valve Co.

Thrust Bearings
(See Ball Bearings and Roller Bearings)

Tiling, Cork
Beaver Tile Co.

Tools, Machine
(See Machine Tools)

Towing Hooks and Cocks
American Engineering Co.

Towing Lines
(See Rope and Wire Rope)

Towing Machines
American Engineering Co.
Lidgerwood Mfg. Co.

Transmission Rope
(See Rope)

Traps
(See Steam Traps)

Traveling Cranes
(See Cranes)

Trolley and Track Systems
McMyler Interstate Co.

Tubes
(See Boiler Tubes; also Condenser Tubes)

Tubes, Rods, Wires
(Copper, Brass and Bronze)
Chase Metal Works
Chase Rolling Mill Co.
Scovill Mfg. Co.

Tube Cleaners
(See Boiler Flue Cleaners)

Tube Expanders
(See Boiler Flue

Tugs
(See Shipbuilders)

Tubing, Steel Aux Steam

Turbines
(See Steam Turbines)

Turnbuckles and Other Wire Rope Accessories
American Engineering Co.
Williams & Co., J. H.

Turret Lathes
(See Lathes, Turret)

Twine
(See Rope; also Cordage)
Columbian Rope Co.
Plymouth Cordage Co.

Unions
(See Pipe Unions)

Upholstery
(See Ship Upholstery)

Vacuum Gauges
(See Steam Gauges)

Vacuum Pumps
Alberger Pump & Condenser Co.
Davidson, M. T., Co.
Ingersoll-Rand Co.
Warren Steam Pump Co.
Westinghouse Electric & Mfg. Co.
Wheeler Mfg. Co.
Worthington Pump & Machinery Corp.

Vacuum Traps
Crane Co., The
Griscom-Russell Co.

Valve Discs
Goetze Gasket & Packing Co.
Pratt & Cady Co.
Reading Valve & Fittings Co.

Valve Reseating Machines
Leavitt Machine Co.

Valves, Cast Steel
Reading Valve & Fittings Co.

Valves
Atlas Valve Co.
Bethlehem Shipbldg. Corp.
Crane Co.
Griscom-Russell Co.
Jenkins Bros.
Jerguson Valve Mfg. Co.
Lunkenheimer Co.
Powell Co., The William
Pratt & Cady Co., Inc.
Reading Valve & Fittings Co.

Valves (Automatic Relief)
Pratt & Cady Co., Inc.
Sands, A. B., & Son Co.

Valves, Ammonia and Carbon Dioxide
Frick Co.
Pratt & Cady Co., Inc.
York Mfg. Co.

Valves—Chronometer
(See Chronometer Valves)

Valves, Float
Atlas Valve Co.

Valves, Reducing
Atlas Valve Co.

Valves, Regulating
Atlas Valve Co.
Crane Co.
Lunkenheimer Co.
Powell Co., The Wm.
Sands & Son Co., A. B.

Valves, Relief
Lunkenheimer Co.

Valves—Rubber
Powell Co., The William
Pratt & Cady Co., Inc.
Sands, A. B., & Son Co.

Valves, Safety
Lunkenheimer Co.

Valves—Water
Crane Co.
Jerguson Gage & Valve Co.
Lunkenheimer Co.
Powell Co., The William
Pratt & Cady Co., Inc.
Sands, A. B., & Son Co.

Vapor Proof Fittings
(See Waterproof Fittings)

Ventilating Fans
(See Blowers)

Ventilators
Sands, A. B., & Son Co.

Ventilating Sets.
B. F. Sturtevant Co.

Vertical Pumps
(See Pumps)

Vessel Brokers
(See Ship Brokers)

Vises—Chain Pipe, Clamp, Mount
Williams & Co., J. H.

Voice Tubes and Fittings
Chase Metal Works
Chase Rolling Mill Co.

Wainscoting
Pantasote Co., The

Wall Radial Drills
(See Radial Drills)

Water Closets, Marine
(See Plumbing)

Water Columns
Crane Co.
Jerguson Gage & Valve Co.
Lunkenheimer Co.
National Tube Co.

Water Gages and Alarms
Crane Co.
Jerguson Gage & Valve Co.
Lunkenheimer Co.
Powell Co., The William

Watertube Boilers
(See Boilers)
Ward Engineering Works
Babcock & Wilcox Co., The

Wattmeters
(See Electrical Instruments)

Welding and Welding and Cutting Apparatus and Supplies
(Oxy-acetylene Process)
Prest-O-Lite Co., Inc.

Welding—Electric
General Electric Co.

Welding Metals
(See Welding and Cutting Apparatus and Supplies)

Welding Rods of All Kinds
Prest-O-Lite Co., Inc.

Wharf Cranes
(See Cranes)

Wharf Drops
American Engineering Co

Whistles
Crane Co.
Lunkenheimer Co.
Powell Co., The William
Sands, A. B., & Son Co.

Whistle Control
Lunkenheimer Co.

Winches
(See Windlasses)
Bethlehem Shipbldg. Corp.
Exeter Machine Works.

Windlasses
American Engineering Co.
American Ship Building Co.
Bethlehem Shipbuilding Corp.
Hadfield-Penfield Steel Co.
Hyde Windlass Co.
Kearfott Engineering Co.
Lidgerwood Mfg. Co.

Wire, Brass
American Brass Co.
Chase Metal Works.
Scovill Mfg. Co.

Wire Rope, Cables and Accessories
American Engineering Co.
Williamsport Wire Rope Co.

Wireless Apparatus and Telegraphs
Radio Corporation of America

Wiring Devices
(See Marine Wiring Devices)

Wiring Machines
The Quickwork Co.

Woodworking Machinery
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co.
Ingersoll-Rand Co.

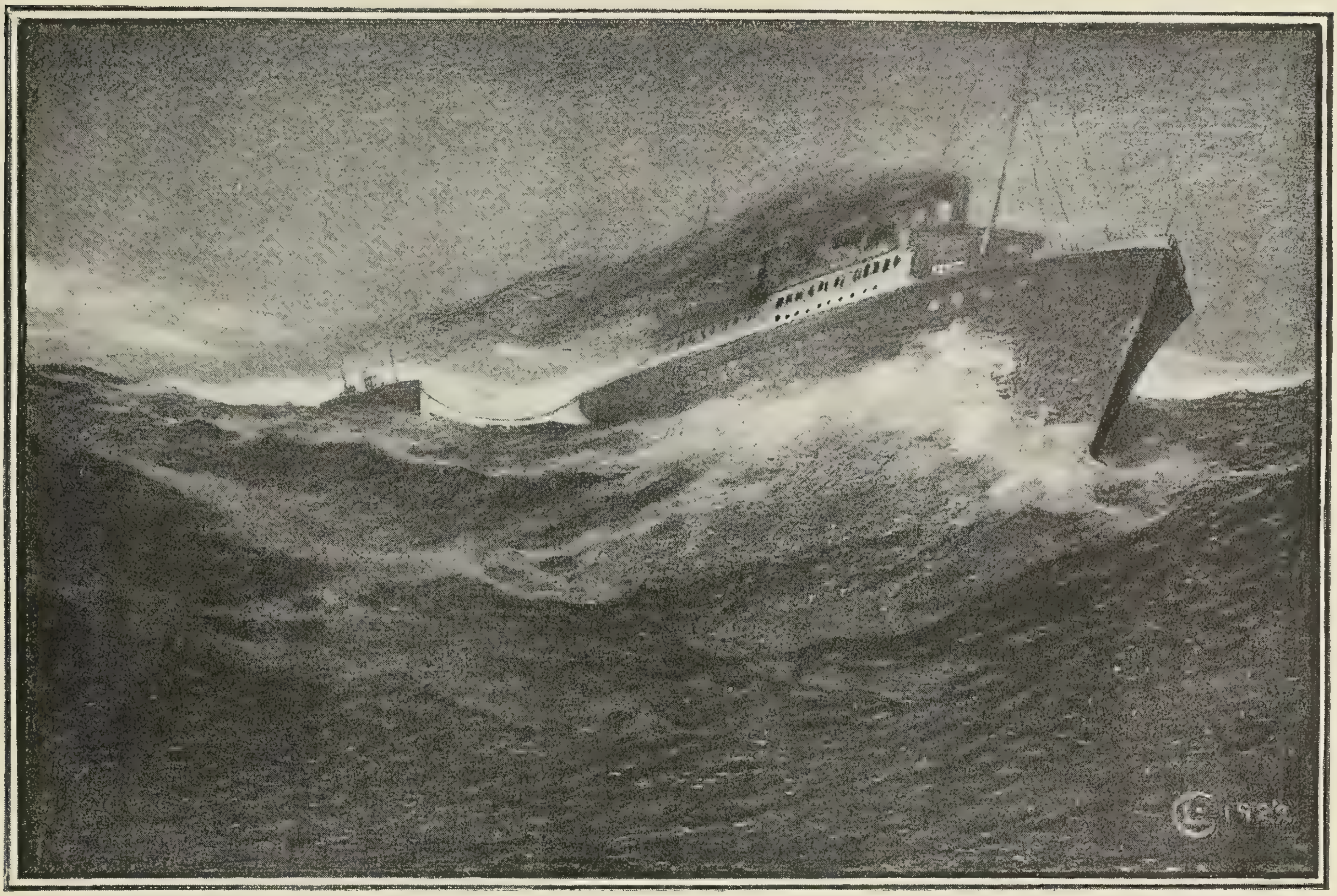
Wrecking Cables
Columbian Rope Co.
Plymouth Cordage Co.

Wrecking Pumps
Davidson Co., M. T.
Warren Steam Pump Co.

Wrenches
(Also Pipe Wrenches)
Coes Wrench Co.
Williams & Co., J. H.

Yacht Brokers
(See Ship Brokers)

Yachts
(See Launches and Yachts)



ALPHABETICAL INDEX TO ADVERTISEMENTS

When a flying boat needs a *lift*

In the hangars of the Aeromarine Airways, Inc., at Keyport, N. J., expert mechanicians are ever watchful of the details which assure the *safety*, *speed*, and *comfort* of travel through the air, enjoyed by those who fly in Aeromarine aircraft.

THE SHEPARD ELECTRIC
LIFTABOUT

They have an ever-ready "helper" in a Shepard Electric *LiftAbout* which always provides a *steady, safe, speedy* "lift" in handling aircraft within the hangar.

It seems that this powerful little hoist knows no lifting problems that it cannot solve.

In your plant or yard, there may be a place where our *LiftAbout* is "just what you've long needed." It will bring to you *good hoisting service at a remarkably low cost.*

SHEPARD ELECTRIC CRANE & HOIST CO.
382 Schuyler Ave., Montour Falls, N. Y.
Branches in Principal Cities.
Member Electric Hoist Mfrs.' Assn. 2315-S

REG. U.S. PAT.OFF.
SHEPARD
ELECTRIC CRANES & HOISTS